COVER SHEET
Public Review Draft – November 2004

Title of Environmental Review:	Environmental Assessment of a National Marine Fisheries Service Action To Issue Direct Take Permits to the Idaho Department of Fish and Game (IDFG) and Northwest Fisheries Science Center (NWFSC) Under Section 10(a)(1)(A) of the Endangered Species Act
Evolutionarily Significant Units:	Snake River Spring/Summer Chinook Salmon Snake River Fall Chinook Salmon Snake River Sockeye Salmon Snake River Steelhead
Responsible Agency and Official:	D. Robert Lohn NOAA – National Marine Fisheries Service 7600 Sand Point Way N.E. Seattle, WA 98115
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Legal Mandate:	Endangered Species Act of 1973, as amended and implemented – 50 CFR Part 223
Location of Proposed Activities:	Idaho, Snake River Basin
Activity Considered:	NMFS' action of issuing permits to IDFG and NWFSC for the take of ESA-listed anadromous fish under the jurisdiction of NMFS associated with captive propagation of endangered sockeye salmon in the Snake River basin of Idaho.

TABLE OF CONTENTS

1. PURPOSE OF AND NEED FOR THE PROPOSED ACTION

1.1 Background

NOAA's National Marine Fisheries Service (NMFS) is the lead agency responsible for administering the ESA as it relates to listed salmon and steelhead. Actions that may affect listed species are reviewed by NMFS under section 7 or section 10 of the ESA or under section 4(d), that can be used to limit the take prohibitions described in section 9. Under section 10(a)(1)(A) of the Endangered Species Act (ESA), Federal or non-Federal entities may apply for permits from the National Marine Fisheries Service (NMFS) to take ESA-listed species under the jurisdiction of NMFS if such taking is for scientific purposes or to enhance the propagation or survival of the affected species. The Hatcheries and Inland Fisheries Branch of the Salmon Recovery Division (SRD), Northwest Region (NWR) of the National Marine Fisheries Service, is responsible for reviewing and recommending action on permit applications involving artificial propagation of listed salmon species in the Columbia River Basin.

NMFS has received two applications for permits to take endangered Snake River sockeye salmon for scientific research and propagation. On December 11, 2002, the NMFS' Northwest Fishery Science Center (NWFSC) applied for a permit to continue the ongoing work on the Redfish Lake Sockeye Salmon Captive Propagation Program. On January 21, 2003, the Idaho Department of Fish and Game (IDFG) submitted an application to continue the work on the portion of the same captive propagation program that falls under state responsibility. The applications are for portions of the same action. The distribution of responsibility and coordination of actions is described below, as the proposed action (Section 2.1). Funding for this program will be provided in large part by the Bonneville Power Administration, as part of the updated proposed action for operation of the Federal Columbia River Hydropower System.

On November 20, 1991, NMFS published a final rule listing Snake River sockeye as endangered under the ESA effective November 20, 1991 (56 FR 58619). At the time of listing, NMFS was in consultation with IDFG regarding the captive propagation program for sockeye, which had been initiated with collection of adult sockeye in August and September of 1991. Since the time of listing, a number of permits have been issued for this activity:

- An emergency section 10(a)(1)(A) permit, number 776, was issued to IDFG to provide coverage for the take of adult sockeye and gametes and the collection of sockeye smolts in the spring 1992 outmigration.
- Permit 776 was replaced by permit 795, issued by NMFS, on July 29, 1992, to cover the ongoing development of captive rearing technology, collection of additional listed fish for founding the broodstock, and holding of the captive fish and their progeny. Transfer of listed fish from IDFG to NWFSC for saltwater rearing was covered by permit 795.
- On June 10, 1996, permit 1005 was issued to NWFSC to cover their expanding role in maintaining a portion of the sockeye captive broodstock.
- In 1998, permits 795 and 1005 were replaced by permit 1120, issued to IDFG, and permit 1148, issued to NWFSC. Permits 1120 and 1148 incorporated numerous modifications

that had been made to the earlier permits and specifically addressed the actions of developing, maintaining the Snake River sockeye captive broodstock and the release of the fish produced into natural habitats. Permits 1120 and 1148 expired on December 31, 2002.

Research and propagation activities for Snake River sockeye have continued under the terms of the expired permits and ongoing consultation, while processing of renewed permits has been delayed due to work load issues. NMFS now proposes to issue section 10(a)(1)(A) permits to the IDFG and NWFSC to continue the Redfish Lake Sockeye Salmon Captive Propagation Program.

The purpose of this environmental assessment (EA) is to evaluate the potential environmental effects as a consequence of the NMFS action of issuing permits to IDFG and NWFSC for the direct take of ESA-listed anadromous fish under the jurisdiction of NMFS associated with the proposed artificial propagation and research activities.

NMFS seeks to consider, through NEPA analysis, how its pending action might affect the natural and physical environment and the relationship of people with that environment. NMFS is also required to review compliance of ESA actions with other applicable laws and regulations. The NEPA analysis provides an opportunity to consider, for example, how the action may affect conservation of non-listed species, socioeconomic objectives that seek to balance conservation with wise use of affected resources, and other legal and policy mandates.

1.2 Description of the Proposed Action

NMFS proposes to issue ESA section 10(a)(1)(A) permit number 1454 to IDFG for the conduct of the Redfish Lake Sockeye Salmon Captive Propagation Program and permit number 1455 to NWFSC for conducting a portion of the same program.

The artificial propagation action proposed by IDFG and NWFSC is to continue to maintain and operate a captive propagation program of endangered adult Snake River sockeye salmon, which was started in 1991. This program has developed over the past 13 years as an effort to prevent extinction of Snake River sockeye salmon and to provide options for recovery of the listed population. The program includes rearing fish from fertilized eggs through maturity in captivity, spawning the mature fish, and rearing their progeny for release into natural habitat. IDFG holds captive broodstock at the Eagle, Idaho, Fish Hatchery. Mature fish are mated, the eggs are incubated and hatched, and the resulting fish are used for scientific research, enhancing the propagation or survival of the listed population, and subsequently releasing fish at life stages varying from eyed eggs to mature adults into the wild. A portion of the rearing of juvenile sockeye occurs at IDFG's Sawtooth Fish hatchery or, because of limited facility space, other fish culture facilities including the Oxbow Hatchery near Cascade Locks, Oregon, which is operated by the Oregon Department of Fish and Wildlife (ODFW). This program is conducted in cooperation with the Shoshone-Bannock Tribes and in conjunction with the NWFSC at the

Manchester Research Station (Washington). The NWFSC portion of the program consists of maintaining some of the broodstock in a separate location to spread the risk of catastrophic losses and exposing some of the fish to salt-water rearing and maturation.

Coordination of interagency cooperation and validation of the scientific basis of proposed actions takes place through the Stanley Basin Sockeye Technical Oversight Committee (SBSTOC), a team of biologists and scientists representing the various agencies and tribes associated with the program. SBSTOC membership includes senior research scientists and aquaculture experts from Idaho Department of Fish and Game, Shoshone-Bannock Tribes, NMFS, and the University of Idaho. The funding agency (Bonneville Power Administration) and the permitting authority (NMFS, SRD, Hatcheries/Inland Fisheries Branch) are also represented on the SBSTOC. The SBSTOC has adopted protocols regarding review of research and fish culture proposals and decision making processes. In addition, other agency personnel with expertise in fish behavior, genetics, fish health and fish culture serve as advisors for specialized decisions. Bi-monthly meetings, which are open to public and other agencies, are held to review status of projects and proposals for actions. This body reviews program activities, coordinates research on specific issues, and makes recommendations for future activities. Specific fish culture protocols (e.g., fish rearing density, rearing container size, water temperature, diet) and specific fish transportation protocols (e.g., temperature tempering, transport density, tank configuration, safety contingency plans) have undergone review by the SBSTOC. The SBSTOC also reviews any research proposals that may involve use of fish from the captive propagation program in studies designed to improve the efficiency of the program and enhance the propagation and reintroduction actions.

The program includes monitoring and evaluation of survival of fish produced by the captive propagation program and the impacts of the program on natural production. The proposed actions are designed to affect only Snake River sockeye salmon. However, listed Snake River Basin steelhead, Snake River spring/summer chinook salmon and Snake River fall chinook salmon may be present in some of the waters that are affected by the permitted activities.

1.3 Purpose Of and Need For the Action

The purpose of the Proposed Action is to permit continued operation of the Redfish Lake Sockeye Salmon Captive Propagation Program. This program was started in 1991, just prior to the listing of Snake River sockeye as endangered under the ESA. The purpose of the program is to increase the abundance of the listed population through artificial propagation and to serve as a safety net to prevent extinction of Snake River sockeye salmon. The operation of the safety-net artificial propagation program is intended to be consistent with the regional and sub-basin salmon recovery plans currently under development in the Snake River basin. The IDFG and NWFSC proposals include the necessary conservation and evaluation measures to ensure that the program operates to benefit the listed species and to monitor the performance of the fish produced.

The need for the Proposed Action is to prevent extinction of this ESU, which declined to only 16 anadromous adult sockeye between 1991 and 1998. Preventing extinction is the first step toward developing a recovery strategy for this ESU. In addition to preventing extinction, the program has increased the abundance of fish in the ESU and has developed and tested captive propagation techniques for application to recovery of listed salmonid species (Flagg et al., in press). Continued operation of the program is necessary to prevent extinction and to preserve some options for restoration and recovery.

1.4 Action Area

The action area for the proposed captive propagation program includes:

- The Stanley Basin Lakes - There are three lakes located in the Stanley Basin area of the upper Salmon River subbasin that serve as nursery lakes for the remnant sockeye population and are the target lakes for restoration. These lakes are Redfish Lake, which is the source of the fish used to found the captive broodstock, Pettit Lake, and Alturas Lake.
- The Migration Corridor – The pathway between the nursery lakes and the ocean that includes Redfish Lake Creek, Alturas Lake Creek, and Pettit Lake outlet, the Salmon River, the Snake River, and the Columbia River.
- Off-site rearing locations – Most of the artificial propagation actions take place at offsite locations including Eagle Fish Hatchery, located near Boise, Idaho, Manchester Research Station and the Burley Creek Hatchery located in Washington near Puget Sound, and Oxbow Hatchery near Cascade Locks, Oregon.

The Snake River basin, including its tributaries, covers 695,000 square miles in six states. The Snake River is the largest tributary to the Columbia River and historically was the most important tributary producing anadromous fish in the entire Columbia basin (NMFS 1995). The Salmon River, tributary to the Snake, is the largest undammed river in the continental United States. The Stanley Basin lakes are located near the headwaters of the Salmon River, some 900 miles from the Pacific Ocean, at elevations between 6,547 and 7,016 feet above mean sea level.

The Salmon River headwaters include the Sawtooth Mountains with numerous peaks over 10,000 feet above sea level. The Pahsimeroi River headwaters include the highest point in Idaho, 12,662-foot Mt. Borah, while the confluence of the Snake and Clearwater Rivers is the lowest point in the state at barely 700 feet elevation. Annual precipitation ranges from less than 5 inches in the desert basins south of the Salmon River to 80 inches in the cedar forests at the head of the Clearwater system. The Salmon and Clearwater drainages include the Selway-Bitterroot Wilderness and the Frank Church/River of No Return Wilderness, which comprise the largest contiguous wilderness in the United States outside of Alaska. Smaller Wilderness Areas including the White Clouds and Buffalo Hump and the Sawtooth and Hells Canyon National Recreation areas are also contained within these drainages. Over 80 percent of the surface area

is public land managed by the Clearwater, Nez Perce, Salmon/Challis, Payette, and Boise National Forests; and the Cottonwood, Salmon, and Challis Resource Management Areas managed by the U.S. Bureau of Land Management and the Idaho Department of Lands.

1.5 Scope

The scope of the action considered here includes only the authorization of take of endangered Snake River sockeye in the course of operation and evaluation of the Redfish Lake Sockeye Salmon Captive Propagation program as conducted by the IDFG, the agency responsible for fishery management within the State of Idaho, and NWFSC, the branch of NMFS that conducts scientific research. Other activities in the Columbia River Basin or outside the Columbia River Basin might have impacts on the abundance and survival of the listed species considered by this opinion. Those other activities have been discarded from analysis in this EA because their planning, regulation, and implementation fall outside the scope of this EA, which is limited to evaluating applications for direct take permits and NMFS' action of issuing a direct take permits under section 10(a)(1)(A) of the ESA.

1.6 Relationship to Other Plans and Policies

The Proposed Action analyzed in this EA relates to other plans and policies regarding the management and restoration of anadromous fish resources in the Pacific Northwest. Artificial propagation, including the use of captive broodstocks and safety-net artificial propagation programs as part of a strategy to recover depleted salmon populations is described in the Basinwide Salmon Recovery Strategy, which was developed by the Federal government to restore ESA-listed salmon and steelhead throughout the Columbia River basin (Federal Caucus 2000).

In addition, the Proposed Action is consistent with on-going ESA recovery planning. Recovery plans are being developed in most sub-basins in the Columbia River system. These recovery plans will contain: (1) measurable goals for delisting, (2) a comprehensive list of the actions necessary to achieve delisting goals, and (3) an estimate of the cost and time required to carry out those actions. All factors that have been identified as leading to the decline of ESA-listed species will be addressed in these recovery plans. For ESA-listed salmon and steelhead, these factors include hydroelectric operations, harvest, habitat use, and artificial propagation.

The primary state plan regarding anadromous fish is the IDFG "Fishery Management Plan 2000-2005" (IDFG 2000), which describes the State policy and plans regarding management and protection of salmon and steelhead. The permit applications (NWFSC 2002, IDFG 2003) describe a conservation plan designed to promote recovery of listed anadromous fish in the Idaho portion of the Snake River basin that is specific to the proposed action.

Other Federal, state, and Tribal plans and policies that would potentially address effects on fish populations in the Snake River basin apply within or near the action area. Federal actions

include Forest Service and Bureau of Land Management land and resource management plans that are designed to foster sustainable ecosystems and resilient watersheds. State initiatives include legislative measures to facilitate the recovery of listed species and their habitats, as well as the overall health of watersheds and ecosystems. State land management, environmental quality, water resources, and agriculture agencies all have policies and plans that address water quality and land use practices that are designed to achieve desirable water quality and resource conditions, some specific to protected species, some more generally addressing water and resource quality. Regional programs are being developed that designate priority watersheds and facilitate development of watershed management plans. Tribes have developed a joint restoration plan for anadromous fish in the Columbia River basin, known as the Wy-Kan-Ush-Mi Wa-Kish-Wit or *Spirit of the Salmon* plan. The Proposed Action is expected to be compatible with the goals and objectives of other regional actions.

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

The Proposed Action and two alternatives considered in this EA are: (1) No Action (i.e., no permits issued), (2) to issue the permits with conditions that specifically address measures to control the take of listed species and manage the risks that may occur concurrent with the captive propagation program (the Proposed Action), and (3) to issue the permits without conditions. The following summary describes major aspects of the Proposed Action and alternatives.

2.1 Alternative 1 (No Action) - Issue No Permit

Under the No Action alternative, NMFS would not issue ESA section 10(a)(1)(A) permits authorizing take of ESA-listed Snake River sockeye salmon in the course of operation and evaluation of the Redfish Lake Sockeye Salmon Captive Propagation Program. This alternative would effectively end the 13-year-old captive propagation program for Snake River sockeye salmon. The program would end with the release of the fish currently in captive propagation, with no additional fish collected or reared.

2.2 Alternative 2 (Proposed Action) - Issue Permits to IDFG and NWFSC to Conduct the Snake River Sockeye Salmon Captive Propagation program

The Proposed Action is to issue permits under section 10(a)(1)(A) of the ESA based on the applications, including attachments, submitted by IDFG and NWFSC as modified by the conditions that NMFS may require as being necessary and appropriate. The applications reflect the adoption of risk-averse protocols that incorporate current science on management of captive propagation in a manner that minimizes risk and ensures benefits to listed species. The proposed action includes limits on the take of listed species, establishing standards for prudent fish husbandry protocols, and monitoring and reporting requirements as terms and conditions to be included in the proposed permits. NMFS' conditions would ensure that the take of ESA-listed Snake River sockeye salmon would benefit the survival and recovery of the species.

Brief descriptions of the proposed captive propagation program and conservation plans are found in the following subsections (2.2.1 through 2.2.5). Additional details can be found in the permit applications and conservation plans (NWFSC 2002; IDFG 2003).

2.2.1 The Captive Broodstock Concept

The Redfish Lake Sockeye Salmon Captive Propagation Program is a safety net program producing fish for restoration of anadromous sockeye salmon runs to the Snake River Basin. In November 1991, NMFS listed Snake River sockeye salmon (*Oncorhynchus nerka*) as endangered under the ESA (Waples et al. 1991). Snake River sockeye salmon are a prime example of a species on the threshold of extinction. The last known anadromous remnants of this stock return to Redfish Lake, Idaho. In 1991 and 1992 combined, only five adult anadromous sockeye salmon returned to Redfish Lake. On the basis of these critically low population numbers, IDFG, in cooperation with NMFS, the Bonneville Power Administration (BPA), the Shoshone-Bannock Tribe, and others, implemented a captive propagation program as an emergency measure to save Redfish Lake sockeye salmon from extinction (Flagg 1993; Johnson 1993; Spaulding 1993; Flagg and McAuley 1994; Flagg et al. 1994; Kline 1994; Teuscher et al. 1994; Flagg et al. 1995a; Johnson and Pravecek 1995, 1996; Kline and Younk 1995; Teuscher et al. 1995; Flagg et al. 1996; Teuscher and Taki 1996; Kline and Lamansky 1997; Pravecek and Johnson 1997; Taki and Mikkelsen 1997; Flagg et al. 1998; Flagg et al. 2001; Frost et al. 2002, 2003, 2004). The Redfish Lake Sockeye Salmon Captive Propagation Program is intended as an emergency gene rescue program that can be used to produce large numbers of juvenile fish for restoring anadromous sockeye salmon runs to the Snake River.

The ESA, in mandating the protection and recovery of listed species, recognizes that conservation of listed species may be facilitated by artificial means, such as captive propagation programs, while factors impeding population recovery are being rectified (Hard et al. 1992). Frequently, restoration of severely depleted populations is hindered by lack of suitable numbers of juveniles for effective supplementation (i.e., release of hatchery-propagated fish to increase natural production), even if factors impeding recovery can be corrected (Flagg et al. 1995a). For restoration of these populations to occur in a timely fashion, the full reproductive potential of Pacific salmon must be harnessed in the short-term to produce large numbers of juveniles. Sometimes, the only reasonable avenue to build populations quickly enough to avoid extinction is through captive broodstock technology (Flagg and Mahnken 1995).

Captive propagation of animals to maximize their survival and reproductive potential has been widely applied to endangered species restoration (Gipps 1991; Johnson and Jensen 1991; DeBlieu 1993; Olney et al. 1994; Flagg and Mahnken 1995). These efforts range from establishment of free-roaming breeding colonies on localized preserves to full-term captive rearing (Gipps 1991; Johnson and Jensen 1991; DeBlieu 1993; Olney et al. 1994; Flagg et al. 1995b). Full-term rearing of captive broodstocks maximizes potential production of juveniles for enhancement. The relatively short generation time of Pacific salmon and their potential to produce large numbers of offspring make them suitable for captive broodstock rearing. Survival advantages offered through protective culture can be significant. Theoretically, survival of fish

reared in protective captive broodstock culture can exceed wild survival by 100-to-1,000 fold (Flagg et al. 1995b). The substantial survival advantage for captive-reared fish provides potential to produce large numbers of juveniles to amplify the natural population during the second generation.

Development of the Redfish Lake Sockeye Salmon Captive Propagation Program

The Redfish Lake Sockeye Salmon Captive Propagation Program has been underway since 1991. The sources of IDFG and NWFSC captive broodstocks are wild juvenile and adult fish captured, held, and spawned by IDFG between 1991 and 1998. During this period, only 16 sockeye salmon adults (0 to 8 individuals per year) returned to Redfish Lake. IDFG divided the gametes from these fish between the NWFSC and IDFG captive broodstock facilities. The NWFSC captive broodstocks are complementary to those reared by IDFG and are intended to reduce the risk of catastrophic loss of this valuable gene pool by maintaining stocks at geographically separate sites. As the numbers of fish and eggs have increased through captive propagation, NWFSC has continued to maintain certain lineages at the Manchester Research Station, as well as provide a level of duplication to reduce the risks of catastrophic loss of the population. IDFG maintains certain lineages and pedigrees of the family lines. Pre-spawning adults, eyed eggs, and juveniles from the NWFSC facilities are returned to Idaho to aid in recovery efforts.

Through 2003, the IDFG and NWFSC hatchery programs have produced in excess of 940,000 pre-smolts, 159,000 smolts, 1,200 adults, and 526,000 eyed-eggs for reintroduction to Sawtooth Valley lakes and tributary streams. From this production, an estimated 390,000 juvenile sockeye salmon have emigrated from Sawtooth Valley waters.

In 1999, the first hatchery-produced anadromous sockeye salmon returned to the Sawtooth Valley. In that year, seven age-3 adults (six males and one female) returned to spawn. In 2000, the program experienced its first large return of hatchery-produced adults – two hundred fifty-seven sockeye salmon returned to collection facilities on Redfish Lake Creek and the upper Salmon River at the IDFG Sawtooth Fish Hatchery. In 2001, 26 hatchery-produced adults returned to collection facilities. In 2002, 22 hatchery-produced adult sockeye salmon returned to the Sawtooth Valley. Fifteen of these adults were captured at Sawtooth and Redfish Lake Creek weir sites. The remaining seven fish were observed in the Salmon River but not handled. In 2003, three anadromous sockeye salmon returned to the Sawtooth Valley; one of these adults was observed immediately downstream of the Sawtooth Fish Hatchery trap but was not handled.

Broodstock Development and Spawning

Broodstock development using wild, Redfish Lake sockeye salmon has included anadromous adults, residual adults, and out-migrating smolts. Wild sockeye salmon represent the potential infusion of new genetic diversity into the breeding program. Since 1991, all 16 wild, anadromous adults sockeye salmon that returned to the Sawtooth Valley have been incorporated

into the breeding program. Residual sockeye salmon adults were captured and used to develop broodstocks in 1992, 1993, and 1995. Twenty-six residual sockeye salmon adults have contributed to the captive propagation program. Wild, out-migrating smolts from Redfish Lake were captured in 1991 - 1993, reared through maturation at the IDFG Eagle Fish Hatchery, and selectively incorporated in the breeding program. During these collection years, 886 out-migrating smolts were captured and transferred to the Eagle Fish Hatchery. Adaptively managed, the program generates hatchery-produced eggs, juveniles, and adults for reintroduction to Sawtooth Valley waters. In addition, emphasis is placed on the annual development of genetically diverse broodstocks.

Spawning has occurred in the Redfish Lake Sockeye Salmon Captive Propagation Program since 1991. Wild anadromous females were spawned in 1991, 1993, 1994, and 1996. Egg survival to the eyed stage of development for wild females has averaged 76%. Hatchery-produced adult sockeye salmon have been spawned yearly since 1994. Mean egg survival to the eyed stage of development has been variable, but has averaged approximately 60%.

Egg and Fish Reintroductions

Since the inception of the program in 1991, the development of egg and fish reintroduction plans has followed a "spread-the-risk" philosophy incorporating several release strategies and multiple lakes. Release strategies were developed by SBSTOC cooperators and reflect tested techniques applied in the commercial aquaculture field as well as in State, Provincial, and Federal agency programs. The program's reintroduction history is summarized below by major release strategy.

Eyed-egg planting. The eyed-egg reintroduction strategy was first implemented in 1996. Eggs destined for this release option are produced at the IDFG Eagle Fish Hatchery and at NWFSC facilities in Washington State. A complete history of eyed-egg plants and estimated hatch results is presented below (Table 1).

Table 1. Redfish Lake Sockeye Salmon Captive Propagation Program eyed-egg release history and estimated hatch results (Kline 2004).

Release year	Release location	No. of eggs planted	Estimated hatch
1996	Redfish Lake	105,000	97%
1997	Redfish Lake	85,378	98%
	Alturas Lake	20,389	72%
1999	Pettit Lake	20,311	74%
2000	Pettit Lake	65,200	79%
2002	Pettit Lake	30,924	91%
2003	Pettit Lake	149,966	pending
2003	Alturas Lake	49,700	pending
	Total	**526,868**	

Pre-smolt planting. The first releases of age-0, hatchery-produced juvenile sockeye salmon to Sawtooth Valley lakes occurred in 1994. Since that time, Redfish Lake has received pre-smolt plants in each year the program has operated. Three pre-smolt release strategies have been employed in Redfish Lake: a mid-summer direct-lake release, a fall direct-lake release, and a fall release from a net pen environment. In 1995 and 1997, Pettit and Alturas Lakes were incorporated in annual release and evaluation activities. Both lakes have received mid-summer and fall, direct-lake introductions of pre-smolts. Pre-smolt release groups are generated from eggs produced at the IDFG Eagle Fish Hatchery and NWFSC facilities in Washington State. Rearing through release takes place at the IDFG Eagle and Sawtooth Fish Hatcheries. All fish are adipose fin-clipped and a portion are PIT tagged to facilitate overwinter survival and out-migration evaluations. Organized by year, the following narrative reviews pre-smolt release results from the Redfish Lake Sockeye Salmon Captive Propagation Program.

In 1994, two pre-smolt release strategies were used to plant 14,119 age-0 sockeye salmon in Redfish Lake. Net pen and fall direct-lake release options received 11,130 and 2,989 pre-smolts, respectively. In 1995, 91,572 hatchery-produced pre-smolts were planted to Sawtooth Valley lakes. Redfish Lake net pen, summer direct-lake, and fall direct-lake release strategies received 28,163, 27,179, and 27,703 fish, respectively. In 1995, Pettit Lake received 8,527 summer direct-lake pre-smolts. In 1996, 1,932 brood year 1995 pre-smolts were planted in Redfish Lake from net pens. In 1997, 255,711 brood year 1996 pre-smolts were planted to Redfish, Alturas, and Pettit lakes over three release strategies. Redfish Lake net pen, summer direct-lake, and fall direct-lake release strategies received 62,907, 21,036, and 68,379 pre-smolts, respectively. Pettit

Lake received 8,643 summer direct-lake pre-smolts and Alturas Lake received 22,250 summer direct-lake and 72,496 fall direct-lake pre-smolts, respectively. In 1998, 141,871 brood year 1997 pre-smolts were planted in Redfish, Alturas, and Pettit lakes over three release strategies. Redfish Lake net pen and fall direct-lake strategies received 55,830 and 39,418 pre-smolts, respectively. Pettit and Alturas lakes received 7,246 summer direct-lake and 39,377 fall direct-lake pre-smolts, respectively. In 1999, Redfish, Pettit, and Alturas lakes received 23,886, 3,430, and 12,955 fall direct-lake pre-smolts, respectively. In 2000, Redfish Lake received 48,051 fall direct-lake pre-smolts. Pettit and Alturas lakes received summer and fall direct-lake release groups. Summer direct-lake releases included 6,007 and 5,986 pre-smolts to Pettit and Alturas lakes, respectively. Fall direct-lake releases included 6,067 and 6,003 pre-smolts to Pettit and Alturas lakes, respectively. In 2001, the following pre-smolt releases were made: Redfish Lake received 41,529 fall direct-lake pre-smolts and 41,474 net pen-reared pre-smolts (fall release). Alturas Lake received 6,123 summer direct-lake pre-smolts and 5,990 fall direct-lake pre-smolts. Pettit Lake received 6,057 summer direct-lake pre-smolts and 4,993 fall direct-lake pre-smolts. In 2002, 140,410 pre-smolts were released over two release strategies to three lakes. In August, 61,500 pre-smolts were released to Redfish Lake; 7,805 pre-smolts to Pettit Lake and 6,123 pre-smolts to Alturas Lake. In October, 45,001 pre-smolts were released to Redfish Lake and 19,981 pre-smolts released to Pettit Lake. On October 6, 2003, Pettit Lake received 14,961 pre-smolts reared at the Sawtooth Fish Hatchery. Fish from this group were adipose fin-clipped (2,014 PIT tags) and had a mean weight of 10.7 grams per fish. On October 6, 2003, an additional 2,017 (100% PIT tagged) adipose fin-clipped pre-smolts (mean weight 8.0 grams/fish) were released to Alturas Lake. On October 6 and 7, 2003, 59,810 pre-smolts (mean weight 11.0 grams/fish) were released to Redfish Lake (1,519 PIT tagged).

The complete pre-smolt release history of the program is summarized below in Table 2.

Table 2. Redfish Lake Sockeye Salmon Captive Propagation Program pre-smolt release history (Kline 2004).

Release Lake	Release Strategy	Release Date	Number Released	Number PIT-tagged	Mean Release Wt.
Redfish	Net pen	8/3/94	11,130	1,904	8.2 g
Redfish	Fall direct-lake	11/23/94	2,989	854	8.1 g
Redfish	Net pen	10/10/95	28,163	1,721	11.4 g
Redfish	Summer direct-lake	6/29/95	27,179	1,731	5.8 g
Redfish	Fall direct-lake	10/5,10/95	27,703	2,520	16.1 g
Pettit	Summer direct-lake	7/27/95	8,527	861	7.4 g
Redfish	Net pen	10/7/96	1,932	1,932	22.0 g
Redfish	Net pen	10/21/97	62,907	2,596	21.1 g
Redfish	Summer direct-lake	7/14/97	21,036	1,990	9.6 g
Redfish	Fall direct-lake	10/15/97	68,379	2,010	21.0 g
Pettit	Summer direct-lake	7/1/97	8,643	1,336	8.7 g
Alturas	Fall direct-lake	10/16/97	72,496	1,861	21.0 g
Alturas	Summer direct-lake	7/15/97	22,250	2,032	8.4 g
Redfish	Net pen	10/1/98	55,830	2,973	14.4 g
Redfish	Fall direct-release	10/14/98	39,418	1,206	10.6 g
Pettit	Summer direct-lake	7/15/98	7,246	1,501	9.8 g
Alturas	Fall direct-lake	10/14/98	39,377	1,246	10.3 g
Redfish	Fall direct-lake	10/6/99	23,886	1,560	9.7 g
Pettit	Fall direct-lake	10/6/99	3,430	2,009	10.4
Alturas	Fall direct-lake	10/6/99	12,955	1,559	10.8 g
Redfish	Fall direct-lake	10/11/00	48,051	Note a	10.8 g
Pettit	Summer direct-lake	7/31/00	6,007	Note a	2.9 g & 8.5 g
Pettit	Fall direct-lake	10/11/00	6,067	Note a	13.9 g
Alturas	Summer direct-lake	7/31/00	5,986	Note a	2.9 g & 8.5 g
Alturas	Fall direct-lake	10/11/00	6,003	Note a	12.8 g
Redfish	Fall direct-lake	10/8/01	41,529	Note a	10.8 g
Redfish	Net Pen	10/10/01	41,474	Note a	30.0 g
Pettit	Fall direct-lake	10/9/01	4,993	Note a	15.4 g
Pettit	Summer direct lake	7/27/01	3,059	Note a	14.4 g
Pettit	Summer direct lake	7/31/01	2,998	Note a	4.0 g
Alturas	Fall direct lake	10/9/01	5,990	Note a	14.0 g
Alturas	Summer direct lake	7/27/01	3,064	Note a	14.5 g
Alturas	Summer direct lake	7/31/01	3,059	Note a	4.0
Redfish	Summer direct-lake	8/28/02	31,000	1,002	11.4 g
Redfish	Summer direct-lake	8/29/02	30,500	-	11.4 g
Alturas	Summer direct-lake	8/27/02	6,123	1,463	10.6 g
Pettit	Summer direct-lake	8/27/02	7,805	1,434	11.4 g
Redfish	Fall direct-lake	10/8/02	45,001	1,015	15.3 g
Pettit	Fall direct-lake	10/8/02	19,981	2,013	14.8 g

Alturas	Fall direct-lake	10/6/03	2,017	2,017	8.0 g
Pettit	Fall direct-lake	10/6/03	14,961	2,014	10.7 g
Redfish	Fall direct-lake	10/7/03	59,810	1,519	11.0g
		Total	**940,954**		

Note a. Unique fin clips used in lieu of PIT tags to estimate overwinter survival and lake out-migration success. Evaluation groups of out-migrants were PIT-tagged when captured emigrating from lakes.

Smolt planting. Hatchery-produced smolt releases were first implemented in 1995. To date, in excess of 159,000 smolts have been released to Sawtooth Valley waters. Two release locations have been used: Redfish Lake Creek and the upper Salmon River near the Sawtooth Hatchery weir. Smolt release groups are generated from eggs produced at the IDFG Eagle Fish Hatchery and NWFSC Fisheries facilities. Rearing through release takes place at the IDFG Eagle and Sawtooth Fish Hatcheries as well as at out-of-state facilities (e.g., ODFW Bonneville and Oxbow Fish Hatcheries). All fish are adipose fin-clipped and a portion are PIT-tagged to facilitate out-migration evaluations. In addition, fish may receive additional fin marks or coded-wire tags to facilitate adult return evaluations.

In 1995, a total of 3,794 brood year 1993 smolts were released in Redfish Lake Creek immediately downstream of the monitoring weir. Rearing through release occurred at the Eagle Fish Hatchery. In 1996, a total of 11,545 brood year 1994 smolts were released in Redfish Lake Creek immediately downstream of the monitoring weir. Eggs were produced from spawning events at NWFSC facilities. Rearing through release occurred at the ODFW's Bonneville Fish Hatchery. All fish were adipose fin and right ventral fin-clipped. In addition, all fish received coded-wire tags. In 1998, a total of 81,615 brood year 1996 smolts were released to Redfish Lake Creek and the upper Salmon River. The majority of fish (67,398) were produced from spawning events that occurred at NWFSC facilities. Rearing through release for this group occurred at the Bonneville Fish Hatchery. Approximately 24,365 and 43,033 fish from this group were released in Redfish Lake Creek and the upper Salmon River, respectively. The remaining 14,217 smolts released in 1998 were produced from brood year 1996 spawn crosses that occurred at the Big Beef Creek Hatchery and the Eagle Fish Hatchery. Rearing and release for this group occurred at the Sawtooth Fish Hatchery. Approximately 999 and 13,218 fish from this group were released in Redfish Lake Creek and the upper Salmon River, respectively. In 1999, a total of 9,718 brood year 1997 smolts were released in Redfish Lake Creek and the upper Salmon River. The release was equally split between release sites (4,859 fish release at each location). Fish were produced from spawning events that occurred at the NWFSC facilities and the Eagle Fish Hatchery. Rearing through release occurred at the Sawtooth Fish Hatchery. In 2000, a total of 148 brood year 1998 Eagle Hatchery-reared smolts were released to Redfish Lake Creek downstream of the weir. In 2001, a total of 13,915 brood year 1999 smolts were released to Redfish Lake Creek. Fish were produced at IDFG and NWFSC facilities and reared through release at the Sawtooth Fish Hatchery. In May 2002, a total of 38,672 age-1 smolts were released directly to Redfish Lake Creek. Fish were produced from spawning events that occurred at NWFSC facilities and the Eagle Fish Hatchery. Rearing through release occurred at

the Sawtooth Fish Hatchery. No smolts were released in 2003.

The complete smolt release history for the program is presented in Table 3, below.

Table 3. Redfish Lake Sockeye Salmon Captive Propagation Program smolt release history (Kline 2004).

Release location	Date released	Number released	Number PIT-tagged	Mean release weight
Redfish Lake Creek	4/21/95	3,794	1,371	177.5 g
Redfish Lake Creek	5/2/96	11,545	1,990	50.0 g
Redfish Lake Creek	4/28, 5/4/98	37,583	2,000	26.5 g & 63.5 g
Upper Salmon River	4/28, 5/4/98	44,032	1,999	26.5 g & 63.5 g
Redfish Lake Creek	5/5/99	4,859	400	25.4 g
Upper Salmon River	5/4/99	4,859	400	25.4 g
Redfish Lake Creek	5/9/00	148	148	258 g
Redfish Lake Creek	5/2/01	13,915	1,000	49.4 g
Redfish Lake Creek	5/7/02	38,672	995	27.6 g
	2003	0		
	Total	**159,407**		

Pre-spawning adult planting. Pre-spawning adult sockeye salmon from the Redfish Lake Sockeye Salmon Captive Propagation Program were first released to Sawtooth Valley waters in 1993. Since that time, adult releases have occurred in 1994, 1996, 1997, 1999, 2000, 2001, 2002, and 2003. For release years 1993, 1994, 1996, 1997, and 2003, all pre-spawning adults released for natural spawning were reared through release (full-term) at IDFG and NWFSC facilities. In 1999 through 2002, release groups consisted of full-term hatchery adults and hatchery-produced anadromous adults. Prior to releasing adults for natural spawning, a sub-set of adults were fitted with ultrasonic or radio transmitters to facilitate tracking and spawning evaluations.

In 1993 and 1994, 20 and 65 maturing adults, respectively, were released to Redfish Lake to naturally spawn. Telemetry observations identified only one incidence of spawning related behavior for the 1994 release group. While no excavation sites were observed, one adult male and female were observed staging over suitable spawning habitat at the south end of Redfish Lake. In 1996, 120 maturing broodstock adults were released to Redfish Lake. During the course of telemetry investigations, approximately 30 areas of excavation (suspected redds) were

observed at the southwest end of Redfish Lake. In 1997, the adult release program was expanded to include Pettit and Alturas lakes. In that year, 80, 20, and 20 adult sockeye salmon were released to Redfish, Pettit, and Alturas lakes, respectively. Telemetry investigations identified suspected test digs in Alturas Lake and only one well developed redd in Pettit Lake. However, approximately 30 well developed redds were once again observed at the south end of Redfish Lake. In 1999, 21 maturing adult sockeye salmon were released to Redfish Lake for natural spawning. The 21 fish consisted of ten brood year 1996 females, eight brood year 1996 males and three brood year 1996 anadromous males that returned to the Sawtooth Fish Hatchery in 1999. Eighteen of the 21 adults were reared from hatch to adult release age at the Eagle Fish Hatchery. The three anadromous males were released from the captive propagation program in 1998 as yearling smolts. Telemetry investigations identified approximately eight redds at the south end of Redfish Lake. In 2000, maturing hatchery-produced anadromous adults and full-term hatchery-produced adult sockeye salmon were released to Redfish (120 anadromous and 46 hatchery), Pettit (28 anadromous) and Alturas (52 anadromous and 25 hatchery) lakes. Prior to release, 19 male sockeye were implanted with radio transmitters (11 anadromous, 8 NOAA Fisheries seawater-reared) to facilitate the identification of spawning site selection. All hatchery- reared sockeye salmon were Floy-tagged prior to release. Redfish Lake received eight radio-tagged adults (four anadromous and four hatchery-reared), Alturas Lake received seven radio-tagged adults (three anadromous and four hatchery-reared), and Pettit Lake received four radio-tagged anadromous adults. In 2001, 65 maturing, hatchery-produced and 14 maturing hatchery-produced anadromous adults were released to Redfish Lake. In 2002, 178 maturing, hatchery-produced and 12 maturing, hatchery-produced, anadromous adults were released to Redfish Lake. In 2003, 280 NWFSC hatchery-reared brood year 2000 adults were released to Redfish Lake. Additionally, 35 IDFG Eagle Fish Hatchery-reared brood year 2000 adults were released to Redfish Lake. No anadromous adults were released in 2003.

A complete history of adult releases from the program is presented in Table 4, below.

Table 4. Redfish Lake Sockeye Salmon Captive Propagation Program pre-spawn adult release history and estimated redd construction results (Kline 2004).

Release Lake	Rearing origin	Date released	Number released	Number of suspected redds observed
Redfish	Full-term hatchery	1993	20	
Redfish	Full-term hatchery	1994	65	One behavioral observation
Redfish	Full-term hatchery	1996	120	30 suspected redds
Redfish	Full-term hatchery	1997	80	30 suspected redds
Pettit	Full-term hatchery	1997	20	1 suspected redd
Alturas	Full-term hatchery	1997	20	Test digs only
Redfish	Full-term hatchery	1999	18	8 suspected redds
	Hatchery-produced anadromous	1999	3	
Redfish	Full-term hatchery	2000	46	20 to 30 suspected redds
Redfish	Hatchery-produced anadromous	2000	120	
Pettit	Full-term hatchery	2000	0	Redds suspected but not visible
Pettit	Hatchery-produced anadromous	2000	28	
Alturas	Full-term hatchery	2000	25	14 to 19 suspected redds
Alturas	Hatchery-produced anadromous	2000	52	
Redfish	Full-term hatchery	2001	65	12 to 15 areas of excavation observed
Redfish	Hatchery-produced anadromous	2001	14	
Redfish	Full-term hatchery	2002	178	10 areas of excavation observed
Redfish	Hatchery-produced anadromous	2002	12	
Redfish	Full-term hatchery	2003	315	42 areas of excavation observed
		Total	**1,201**	

Juvenile Out-migration

Juvenile out-migration monitoring is conducted annually to estimate over-winter survival and outmigration success for sockeye salmon reintroduced to Redfish, Alturas, and Pettit Lakes as pre-smolts. The IDFG maintains and operates the juvenile out-migration monitoring facility on the outlet of Redfish Lake. Trapping history and results for the Redfish Lake Creek site are presented below. Alturas and Pettit lake monitoring efforts are the responsibility of the Shoshone-Bannock Tribes (BPA Project No. 199107100).

Marked, hatchery-produced smolts first out-migrated from Redfish Lake in 1995. In that year, an estimated 823 hatchery smolts out-migrated past the juvenile trapping facility on Redfish Lake Creek (5.8% of number supplemented in 1994). The majority of these fish were produced from the net pen option employed in 1994. In addition to out-migration resulting from 1994 pre-smolt introductions, 3,794 age-1 hatchery-produced smolts (released in Redfish Lake Creek downstream of the monitoring weir) contributed to the 1995 out-migration. Overall, an estimated 4,974 sockeye salmon smolts out-migrated from Redfish Lake in 1995.

In 1996, Redfish Lake out-migrant run size was estimated at 923 unmarked and 12,075 hatchery-produced smolts. Over winter survival and out-migration success for age-1 out-migrants planted over three pre-smolt release options in 1995 averaged 14.5%. Based on PIT tag interrogations, the 1995 fall direct-lake release group out-migrated significantly better than net pen or summer direct-lake release groups. In May of 1996, 11,545 yearling smolts were released directly to Redfish Lake Creek. Therefore, the total 1996 estimated out-migration for Redfish Lake was 24,543 fish. In 1996, an estimated 2,640 hatchery-produced smolts emigrated from Pettit Lake.

In 1997, unmarked and hatchery-produced out-migration was estimated at 304 and 401 fish, respectively. All hatchery-produced out-migrants originated from one 1996 net pen release. Over winter survival and out-migration success for age-1 hatchery-produced smolts averaged 20.7% of the number introduced to the lake in 1996. As no pre-smolts were planted in Pettit Lake in 1996, no 1997 out-migration was detected. In addition, no yearling smolts were planted to outlet streams in 1997.

In 1998, an estimated 2,799 unmarked and 28,435 hatchery-produced fish emigrated from Redfish Lake. In addition, 13,218 smolts were released in Redfish Lake Creek. As mentioned above, the majority of unmarked production was most likely attributed to eyed-egg and pre-spawn adult releases that occurred in 1996. The hatchery-produced smolt estimate represents 18.6% of the number of pre-smolts introduced in 1997 over three release strategies. As was true in 1996, fall direct-lake fish out-migrated significantly better than net pen or summer direct-lake release groups. In 1998, the Shoshone-Bannock Tribes estimated that approximately 30,000 hatchery-produced smolts emigrated from Alturas Lake. This number represents approximately

34.2% of the number introduced in 1997 as pre-smolts. Fall direct-lake out-migrants survived winter and out-migrated significantly better than summer direct-lake out-migrants. Pettit Lake smolt out-migration was estimated at approximately 950 fish (11.0% of number supplemented in 1997). Yearling smolt reintroductions to Sawtooth Valley waters totaled 81,615 fish bringing the total 1998 estimated out-migration to approximately 143,000 smolts.

In 1999, Redfish Lake out-migrant run size was estimated at 1,936 unmarked and 22,425 hatchery-produced fish (17,555 fall direct-lake and 4,870 net pen fish). The estimated number of hatchery emigrants represents 23.5% of the number of pre-smolts planted in 1998. As was the case in previous years, fall direct-lake fish over wintered and out-migrated significantly better than summer direct-lake release fish. The Shoshone-Bannock Tribes estimated that approximately 12,000 and 4,000 hatchery-produced smolts out-migrated from Alturas and Pettit lakes, respectively, in 1999. These numbers represent 30.5% and 61.8% of the original number of pre-smolts planted in these lakes in 1998. In addition, an estimated 1,000 unmarked smolts emigrated from Alturas Lake in 1999. Unmarked production is presumably associated with eyed-egg and pre-spawn adult released conducted in 1997. Combined with a 1999 smolt release of 9,718 fish from the hatchery program, total Sawtooth Valley smolt out-migration in 1999 was estimated at 51,576 fish.

In 2000, Redfish Lake out-migrant run size was estimated at 302 unmarked and 6,962 hatchery-produced fish. The hatchery-produced emigration estimate represents 29.2% of the number of pre-smolts planted in Redfish Lake in 1999. All Redfish Lake out-migrants were produced from a fall direct-lake release strategy. In 1999, the Shoshone-Bannock Tribes estimated that 4,416 and 1,593 hatchery-produced smolts out-migrated from Alturas and Pettit lakes, respectively. Out-migration estimates for Alturas and Pettit lakes represent 34.1% and 46.6% of the number of pre-smolts supplemented to these lakes in 1999. Combined with a 148 fish smolt release group from Eagle Fish Hatchery, total Sawtooth Valley smolt out-migration for 2000 was estimated at 13,405 fish.

In 2001, 110 unmarked and 9,616 hatchery-produced smolts were estimated to have emigrated from Redfish Lake. The unmarked component was produced by a combination of residual adults and the 21 hatchery-produced adults released to spawn volitionally in the lake in 1999. The hatchery-produced component (9,616) was generated primarily from the 48,051 pre-smolts planted in the lake in 2000 (20% over-winter survival). In 2001, the Shoshone-Bannock Tribe estimated that 5,010 and 1,969 smolts emigrated from Alturas and Pettit lakes, respectively. These numbers represent 41.8% and 16.3% of the number of pre-smolts planted to each lake in 2000 (11,989 planted in Alturas Lake and 12,074 planted in Pettit Lake).

In 2002, Redfish Lake out-migrant run size was estimated at 3,461 wild/natural fish, 16,617 direct released and 3,622 net pen released hatchery-produced fish. Hatchery out-migrants (20,239) were generated primarily from the 83,003 pre-smolts planted in 2001 (24.4% over-winter survival). Unmarked out-migrants originated primarily from the release of 21 pre-spawn adults in 1999 and 166 pre-spawn adults in 2000. In 2002, the Shoshone-Bannock Tribe

estimated that 9,850 (6,176 unmarked, 3,674 marked) and 3,410 (1,067 unmarked and 1,803) smolts emigrated from Alturas and Pettit lakes, respectively. Marked emigrants originated primarily from pre-smolt releases of 12,113 to Alturas and 11,050 to Pettit Lake in 2001. Alturas Lake unmarked emigrants originated from the release of 77 pre-spawn adults in 2000. Pettit Lake unmarked out-migrants originated from the planting of 20,311 and 65,200 eyed-eggs in 1999 and 2000, respectively in addition to the release of 28 pre-spawn adults in 2000.

In 2003, Redfish Lake out-migrant run size was estimated at 4,637 wild/natural fish, 6,874 fall direct-released fish and 5,352 summer direct-released fish. The Shoshone-Bannock Tribe estimated that 13,337 smolts out-migrated from Pettit Lake. Alturas lake out-migration was estimated at approximately 553 fish.

Adult returns to the program

The first hatchery-produced adults returned to Idaho in 1999 when six age-3 males (called "jacks") and a single age-3 female (a "jill") were captured. All sockeye salmon captured were marked with adipose and left ventral fin clips. All returning adults originated from a hatchery release of smolts to the upper Salmon River and to Redfish Lake Creek in 1998. Fish were produced from spawn crosses performed at NWFSC facilities. Eyed-eggs were transferred to the ODFW's Bonneville Fish Hatchery for hatch and rearing to release age. Three males and the single female were retained for hatchery spawning. Three males were released to Redfish Lake for natural spawning.

In 2000, 257 anadromous sockeye salmon returned to the Sawtooth Valley. Traps on Redfish Lake Creek and the upper Salmon River at the Sawtooth Fish Hatchery intercepted 119 and 124 adults, respectively. Additionally, 14 adult sockeye salmon were observed immediately downstream of the Sawtooth Fish Hatchery trap but were not handled. Forty-three of the 243 adults handled were retained for spawning. The remaining adults were released to Redfish Lake (120), Pettit Lake (28), and Alturas Lake (52) for natural spawning. Year 2000 returning adult sockeye salmon originated from a variety of release options including: (1) 1996 pre-spawn adult and eyed-egg releases in Redfish Lake, (2) 1997 pre-smolt releases in Redfish, Alturas, and Pettit lakes, and (3) 1998 smolt releases in Redfish Lake Creek and the upper Salmon River. The 1998 smolt release consisted of fish reared at the Sawtooth Fish Hatchery and at the Bonneville Fish Hatchery. One hundred-ninety of the 243 fish handled and examined in 2000 were produced from spawn crosses performed at NWFSC facilities. Eyed-eggs were transferred to the ODFW's Bonneville Fish Hatchery for hatch and rearing to release age. Fish were released to Redfish Lake Creek and the upper Salmon River as smolts in 1998.

In 2001, 26 anadromous sockeye salmon were observed at collection facilities on Redfish Lake Creek and the upper Salmon River. Twenty-three of these fish were collected and temporarily held at the Sawtooth Fish Hatchery. Returning adult sockeye originated primarily from pre-smolt releases conducted in 1998, smolt releases conducted in 1999, and pre-spawn adult releases and eyed-egg plants conducted in 1997. From these releases, an estimated 49,879

smolts emigrated from the Stanley Basin in 1999 (37,225 from pre-smolt plants, 9,718 from smolt plants, and 2,936 from pre-spawn adult releases and eyed-egg plants). Two of the 23 adults handled in 2001 were age-5 fish produced in brood year 1996. In addition, four of the 23 adults were unmarked indicating that they originated from the 2,936 smolts produced from pre-spawn adult releases or eyed-egg plants. In 2001, fourteen of the 23 adults were released to Redfish Lake for natural spawning and nine were retained for spawning in the hatchery.

In 2002, 22 anadromous sockeye salmon returned to the Sawtooth Valley. Traps on Redfish Lake Creek and the upper Salmon River at the Sawtooth Fish Hatchery intercepted 8 and 7 adults, respectively. Additionally, seven adult sockeye salmon were observed immediately downstream of the Sawtooth Fish Hatchery trap but were not handled. Fish were captured between July 31 and September 12, 2002. Three adults died at the Sawtooth Fish Hatchery during holding. On September 12, 2002, the remaining 12 adults were released to Redfish Lake for natural spawning. No anadromous adults were held for spawning.

In 2003, three anadromous sockeye salmon returned to the Sawtooth Valley. Traps on Redfish Lake Creek and the upper Salmon River at the Sawtooth Fish Hatchery intercepted two and zero adults, respectively. Additionally, one adult sockeye salmon was observed immediately downstream of the Sawtooth Fish Hatchery trap but was not handled. Fish were captured between August 1 and August 18, 2003. The trapped adult sockeye salmon (both female) were adipose fin-clipped, indicating returns from a calendar year 2000 presmolt release to either Redfish, Alturas, or Pettit lakes. The two marked females were utilized in hatchery spawn crosses at IDFG Eagle Fish Hatchery.

The Redfish Lake Sockeye Salmon Captive Propagation Program has reached its goal of building the captive population as a safety net to maintain the gene pool. The program is now focusing on producing sufficient numbers of captive broodstock progeny so that they can be used meaningfully in release efforts designed to restore anadromous sockeye salmon runs to the Snake River Basin. These restoration efforts have returned 7 anadromous adults in 1999, 257 in 2000, 26 adults in 2001, and 23 adults in 2002 to Snake River Basin lakes. The vast majority of these returning adults were produced by the release of smolts from the NMFS program that were reared at ODFW's Bonneville Hatchery. These returns clearly demonstrate that the captive propagation program is succeeding both as a safety net and as a tool to restore anadromous salmon runs. IDFG and NWFSC personnel believe that it is highly likely that Redfish Lake sockeye salmon would have become extinct without the supplementation and safety net provided by the captive broodstock.

Broodstock Collection at Lower Granite Dam

Adult sockeye salmon returning to the Snake River system are counted as they pass through the fish ladder at Lower Granite Dam, the most up-river of the four Snake River dams. Lower Granite Dam is located on the Snake River at Snake River mile 107.5, approximately 431.8 miles from the Pacific Ocean, and has a full-pool elevation of 738 feet above mean sea level.

Sawtooth Hatchery is located 896.7 miles from the Pacific Ocean at an elevation of 6,400 feet mean sea level. Therefore, sockeye salmon must travel approximately 465 miles and climb more than 5,600 feet as they migrate up the Snake and Salmon Rivers between these two points. In recent years, fewer than

Table 5. Adult sockeye returns to Lower Granite Dam and Sawtooth Valley traps 1999-2004.

Year	Lower Granite Dam Count	Return to Sawtooth Valley	Percent conversion from LWG to Sawtooth
1999	14	7	50%
2000	299	257	86%
2001	36	26	72%
2002	55	22	40%
2003	12	3	25%
2004	110	24[1]	22%

1 Six sockeye entered traps, 18 were seined from the pool below the Sawtooth hatchery weir.

50% of the migrating sockeye have completed the journey between Lower Granite Dam and the broodstock collection weirs at Sawtooth Hatchery and Redfish Lake (Table 5). The IDFG has proposed that the SBSTOC consider trapping adult sockeye at Lower Granite Dam and transporting the fish to Eagle Hatchery or the Sawtooth Valley for spawning. This may be an effective measure for short-term increases in contribution to spawning and broodstock from the anadromous portion of the population, however, the facilities and logistics of this proposal have not been fully developed. Implementation of this option for improving survival of adult migrants would require improved facilities for trapping, holding, and transporting adult sockeye between Lower Granite Dam and Eagle hatchery. Additional disease and genetic screening for fish would be necessary. The proposed permit would include a condition that such a trap-and-transport action for adult sockeye salmon could be implemented at Lower Granite Dam in years of anticipated poor (e.g., less than 50% likelihood) upstream migration survival, as determined by the SBSTOC.

Conservation Plan

The research/enhancement activities proposed in the permit applications would occur within the area described above and would generally consist of the following measures.

1) Maintain the broodstock of Snake River sockeye salmon in captivity at Eagle, Manchester, and Burley Creek fish culture facilities from the date of permit issuance through 2009.

2) Rear sockeye to maturity in captivity, artificially spawn mature fish and incubate, hatch, and rear the resultant eggs and juvenile fish.

3) Follow a conservation plan that includes mating protocols designed to protect the genetic diversity of the cultured population.

4) Release eyed eggs, juvenile sockeye, and mature adult sockeye produced by the program to the nursery lakes and migration corridor, testing various release strategies.

5) At the smolt stage, transfer a portion of the fish to Manchester Research Station in Washington state, operated by NWFSC, for rearing to adulthood in salt water.

6) Retain a portion of the captive-reared smolts at Eagle Fish Hatchery for rearing to adulthood in freshwater.

7) Use standard fish culture practices and approved therapeutants while holding, transferring, and rearing the listed salmon in captivity.

8) When the captive-reared salmon reach maturity, transport them to Eagle for spawning or the nursery lakes for natural spawning.

9) Capture anadromous adult sockeye returning to the upper Salmon River and the nursery lakes at weirs and traps located in the upper Salmon River or at Lower Granite Dam for inclusion in the captive broodstock, smolt production, and natural spawning releases.

10) Monitor the spawning success and survival and migration of the progeny of both the captive-reared and natural-origin salmon, using methods and equipment as necessary to collect and observe fish. Mark smolts with internal and visible external tags or marks as necessary to track migration and evaluate survival.

11) Collect biological samples from adult and juvenile sockeye as necessary for monitoring and evaluation of program effects

12) Coordinate all decisions and comply with recommendations produced by the Stanley Basin Sockeye Technical Oversight Committee described in section 1.2.

NMFS proposes to issue two section 10(a)(1)(A) permits for the maintenance and operation of the Redfish Lake Sockeye Salmon Captive Propagation Program to IDFG and NWFSC, with special conditions designed to minimize impacts to listed species. NMFS' non-discretionary conditions would ensure that annual direct and incidental take of endangered Snake River sockeye salmon and incidental take of Snake River spring/summer and fall chinook salmon and

Snake River Basin steelhead will not appreciably reduce the likelihood of survival and recovery of these species in the wild. Specifically, NMFS conditions are designed to minimize adverse impacts on ESA-listed fish resulting from the captive propagation program that may involve collecting and spawning of adult Snake River sockeye salmon, using the resulting progeny in scientific research, enhancing the propagation or survival of the listed population, and subsequently releasing juveniles that are the progeny of listed fish into the wild, as conducted at hatchery facilities. Of primary concern in the development of the conditions for the proposed permit is the necessity to take special measures to avoid adverse impacts from artificial propagation and to preserve the genetic and life history characteristics of the listed species. A list of the Special Conditions to be placed in the permit follows:

2.2.2 Conditions

The direct take and incidental take of listed anadromous salmonids is subject to the provisions of the Permit Holder's application and the conditions specified in the permit issued by NMFS, as follows:

1. Prudent fish husbandry practices and standard hatchery protocols must be followed to ensure health and survival of listed juvenile sockeye salmon and embryos.
   a) Fish husbandry protocols must follow American Fisheries Society (AFS), Integrated Hatchery Operation Team (IHOT), and similar guidelines approved by NMFS.

   b) Diseased, moribund, or non-productive fish and gametes should be removed from the captive-reared population and disposed of following AFS Fish Health Blue Book and Pacific Northwest Fish Health Protection Committee guidelines to ensure overall health of rearing groups.

   c) Rearing protocols that maximize the survival of fish reared in captivity and avoid the risks of artificial selection in the hatchery environment must be utilized.

2. IDFG and NWFSC must participate in a coordinated planning process to review the operation of and anticipated changes to the captive propagation program. The coordinated planning, through the Stanley Basin Sockeye Technical Oversight Committee, will address:

   a) fish culture procedures for rearing captive fish to maturity,
   b) use of maturing fish,
   c) synchronization of maturation schedules for adult fish,
   d) cryopreservation of sperm,
   e) influence of non-native hatchery fish

f) evaluation of different captive-brood approaches (out planting of adults vs. release of juveniles),
g) identification of facilities, resources, and strategies to successfully rear juvenile fish to maturity,
h) use of listed sockeye from the captive brood program in research designed to improve the propagation and survival of the listed species, and
i) the disposition of hatchery-reared fish that are excess to the conservation and reintroduction purposes of the program.

3. The ESA-listed fish used for research/enhancement activities may only be taken by the means, in the areas, and for the purposes set forth in the application and modification requests, as limited by the terms and conditions specified in this permit.

4. To the extent possible, eggs and juvenile salmon for captive broodstock are to be selected to represent the entire genetic spectrum of the founding population.

5. IDFG and NWFSC and their cooperators shall make a concerted effort to monitor and evaluate the spawning success of natural and captive-reared adults and the status of natural reproduction, using smolt traps, dip or seine nets, snorkel surveys, tag-and-recovery techniques, and parent-progeny genetic analyses.

6. ESA-listed fish must be handled with care and kept in water to the maximum extent possible during sampling and processing procedures. Adequate circulation and replenishment of water in holding units is required.

7. ESA-listed fish must not be handled when water temperatures exceed 68 degrees Fahrenheit (20 degrees Celsius). Under these conditions ESA-listed fish may only be counted and identified.

8. To minimize lateral transfer of pathogens, a sterilized needle must be used for each individual injection when PIT-tagging listed fish.

9. Release or transfer of any captive-reared salmon or progeny of captive-reared salmon may only be conducted following protocols and schedules approved by the SBSTOC. Notification describing proposed releases must be provided to NMFS one month prior to any such releases (See Operational Reports and Notification Requirements D.3.).

10. IDFG and NWFSC may collect tissue samples from the ESA-listed fish collected from the wild or reared in the captive-rearing program. The tissue samples shall be analyzed to provide a genetic baseline to be used to determine the effects of captive rearing program on ESA-listed Snake River sockeye salmon.

11. IDFG and NWFSC may collect fish or tissue samples from the ESA-listed fish collected as outmigrant smolts from the wild or reared in the captive-rearing program as necessary to conduct annual proximate analysis surveys and fish health preliberation sampling.

12. IDFG and NWFSC shall outplant, incinerate, or bury all dead ESA-listed fish produced from the program if there is not a research, educational, Tribal, or public outreach purpose identified. Each annual report must include the purpose, lineage, number, and location of all educational or public outreach programs that displayed or received ESA-listed fish from IDFG AND NWFSC during the preceding year. Educational and outreach activities that do not display or receive ESA-listed fish from this program are not required to be included in the report, but may be included.

13. IDFG and NWFSC must conduct spawning grounds surveys to estimate natural spawning escapement and to determine the affects of captive-reared fish on spawner distribution and behavior.

14. The Terms and Conditions of the section 10 permit concerning samples collected under this authorization remain in effect as long as the material taken is maintained under the authority and responsibility of the Permit Holder. Tissues of collected animals are the responsibility of the Permit Holder and remain so as long as they are useful for research purposes. Transfer of the tissues from the Permit Holder to other researchers requires written approval from the NW Regional Administrator of NMFS, or his representative.

Reporting requirements

For the duration of this permit, work in each succeeding year is contingent upon submission and approval of a report on each preceding year's research/enhancement activities. Annual reports are due by March 31 of each year. The report contact is:

Technical Specialist
Hatcheries and Inland Fisheries Branch
NOAA Fisheries, Snake River Field Office
10215 W. Emerald St
Boise, ID 83704
Phone: (208) 378-5614

The annual report must include:

1. a description of activities conducted under this permit, including the total number of fish taken, the number of ESA-listed fish taken at each location, the manner of take, the dates and locations of take, and the disposition of each fish, including a description of how all take estimates were derived;

2. a schedule of proposed collections and releases for the year, developed by IDFG and NWFSC in cooperation with the SBSTOC. The schedule shall include preseason estimates of expected natural and captive-reared fish returns to each target area and the proposed collection protocols for the upcoming year. IDFG and NWFSC shall identify the expected final disposition of all listed salmon produced, the potential impacts to the naturally-produced sockeye salmon from the strategies selected, and the monitoring efforts to measure these impacts.

3. a description of IDFG and NWFSC's efforts to monitor and evaluate the success of the Redfish Lake Sockeye Salmon Captive Propagation Program, including the number of ESA-listed fish collected for broodstock and released for natural spawning escapement, the number and distribution of redds counted, survival rates, rearing densities, smolt production and other monitoring results;

4. measures taken to minimize impacts to ESA-listed fish and the effectiveness of those measures, the condition of ESA-listed fish used for research/enhancement activities, a description of the effects of research/enhancement activities on the subject species, the disposition of ESA-listed fish in the event of mortality, and a brief narrative of the circumstances surrounding injuries or mortalities of ESA-listed fish;

5. the purpose, lineage, number, and location of all ESA-listed fish displayed by educational or public outreach programs that received fish from IDFG and NWFSC during the preceding year;

6. a narrative description of any problems that may have arisen during research/enhancement activities and a statement as to whether the research/enhancement activities had any unforeseen effects;

7. a summary of all mortality patterns of ESA-listed fish in the hatchery;

8. any preliminary analysis of scientific data;

9. the results of annual spawner surveys conducted by the program operators and their cooperators; and

10. steps that have been taken to coordinate research and artificial propagation activities with co-managers.

Final Report: The Permit Holders must submit a final report within ninety (90) days of the expiration of this permit summarizing the results of the research and the success of the research relative to its goals.

Notification Requirements and Operational Reports

1. Exceeding Authorized Take If the authorized level of take, including mortalities, is exceeded or if circumstances indicate that such an event is imminent, the Permit Holder must notify NMFS as soon as possible, but no later than two days after the authorized level of take is exceeded. The Permit Holder must then submit a written report to the above contact describing the circumstances of the unauthorized take. Pending review of these circumstances, NMFS may suspend activities or amend this permit in order to allow activities to continue.

2. Taking of Unauthorized ESA-listed Species If any ESA-listed species not included in this permit is killed, injured, or collected during the course of research and enhancement activities, the Permit Holder must notify NMFS as soon as possible, but not later than two days after the event. The Permit Holder must then submit a written report, describing the circumstances of the unauthorized take. Pending review of these circumstances, NMFS may suspend activities or amend this permit in order to allow activities to continue.

3. Transfer of Biological Samples The transfer of any biological samples from the Permit Holder to researchers other than those specifically identified in the application requires written approval from NMFS.

4. Unintentional Killing of Authorized ESA-Listed Species In the event that an ESA-listed species, other than those authorized, is killed, the Permit Holder must notify NMFS verbally as soon as possible, but no later than two days following the event. The Permit Holder must then submit a written report to the above contact describing the circumstances surrounding the event. The Permit Holder must re-evaluate the techniques that were used and those techniques must be revised accordingly to prevent further injury or death. Pending review of these circumstances, NMFS may suspend this permit or issue an amendment in order to allow research and enhancement activities to continue.

2.3 Alternative 3 - Issue a Permit Without Conditions

The other alternative considered is the issuance of permits under section 10(a)(1)(A) of the ESA for the program proposed by IDFG and NWFSC without placing limits on numbers collected or specifying conditions for the operation and maintenance of the captive propagation program. The applications submitted by IDFG and NWFSC reflect the adoption of protocols for artificial propagation of listed species that are risk-averse and include current science on management of hatchery facilities and genetic impacts of artificial propagation. NMFS has been involved with IDFG and NWFSC since 1991 in the design, operation, monitoring, and evaluation of the Redfish Lake Sockeye Salmon Captive Propagation Program, and the conservation measures adopted by IDFG and NWFSC reflect the most current knowledge of best artificial propagation practices. However, this alternative does not acceptably address remaining uncertainties about the affects of the program on the preservation and eventual recovery of the endangered sockeye population.

Under Alternative 3, the permit issued pursuant to section 10(a)(1)(A) would authorize the IDFG and NWFSC to operate the captive propagation program without restrictions or conditions. The difference between the Proposed Action and Alternative 3 is that, under the Proposed Action, NMFS would require IDFG and NWFSC to monitor and evaluate the effects of the captive propagation program on listed species, apply protective measures to minimize affects on listed species, and to report and document the effectiveness of the protective measures. Establishing conditions in permits ensures that measures will be implemented by the Permit Holder to minimize adverse impacts on ESA-listed fish and that agency actions will enhance the propagation or add to scientific knowledge regarding ESA-listed species. In addition, NMFS' conditions may serve to further limit the proposed activities in such a way as to enhance the proposed conservation efforts.

2.4 Potential Alternatives Considered, But Not Analyzed in Detail

NMFS did not identify any other alternatives that would meet the purpose and need for this Proposed Action.

3. AFFECTED ENVIRONMENT

The Proposed Action would potentially affect the physical, biological, social, and economic resources within the proposed action area. Below is a summary of the major components of the environment that could be affected and the current baseline condition.

3.1 Riparian Habitat

The Redfish Lake Sockeye Salmon Captive Propagation Program would take place on a very small area of approximately 5,000 miles of stream within the range of anadromous fish in the Snake River basin. Possible impacts on riparian vegetation and habitat by the program could occur primarily through installation and operation of weirs and the existence of hatchery

facilities. Riparian habitat conditions in the basin as a whole vary from pristine alpine meadows deep inside designated Wilderness to rip-rapped embankments along major highways and in urban areas. The geology is primarily granite of the Idaho batholith and basalt of the Columbia River formations. Studies from the Interior Columbia Basin Ecosystem Project state that many areas in the Interior Columbia basin are showing a reduction in the large tree component and a decline in shrublands in the riparian zones in most of the ecological reporting units (Quigley and Arbelbide 1997). There has been extensive modification of riparian areas in the past by various land uses, including grazing, logging, mining, agriculture, urbanization, and roads that parallel and cross some stream segments.

3.2 Water Quality

Water quality in the Snake River basin has been impacted by a variety of past and present land and water uses, and may be a factor limiting fish production in some areas (NMFS 1995). Idaho Department of Environmental Quality has listed over 160 stream segments on the 1998 303(d) summary of streams with impaired water quality (IDEQ 1998). The only stream segment on the state 303(d) list that could be affected by the proposed action is the upper Salmon River from Hellroaring Creek (which enters the Salmon River at river mile 392.1) downstream to the mouth of the East Fork Salmon River (Salmon River mile 343). Water quality in this section is limited by elevated temperatures and increased sediment related to irrigation water withdrawals, land use, and highway maintenance. More generally, water quality may be impaired by sedimentation from past road building, mining, grazing, and recreational activities, as well as municipal and industrial discharge. Fish culture operations, such as the sockeye captive propagation program, may affect water quality by discharging nutrients or pollutants to streams. An alternate effect on water quality is related to the presence of salmonid carcasses in the water, as a result of dying after spawning, or dying during unsuccessful upstream migration. Freshwater stream environments in the Pacific Northwest are generally cold and lacking in dissolved nutrients. Anadromous salmon are a major vector for transporting marine nutrients across ecosystem boundaries (i.e., from marine to freshwater and terrestrial ecosystems). Nutrients and biomass extracted from the decomposing carcasses, eggs, and milt of spawning salmon restore the nutrients of aquatic ecosystems and stimulate biological production (Cederholm et al. 1999). Nutrients originating from salmon carcasses are also important to riparian plant growth. Direct consumption of salmon carcasses and secondary consumption of plants and small animals, which are supported by carcasses, are important sources of nutrition for both aquatic and terrestrial wildlife (Cederholm et al. 1999).

3.3 Anadromous Fish Listed under the ESA

Anadromous salmon reach the headwaters of the Salmon River at elevations more than 6,500 feet above sea level and a distance of over 900 miles from the ocean. Although dams have blocked access to about one-third of the habitat formerly occupied by anadromous fish in the Snake River basin, in excess of 5,000 stream miles, representing approximately two-thirds of the historically available spawning and rearing habitat within the Idaho portion of the Snake River

basin, remain available to anadromous fish (IDFG 1985). Many of the historically most important spawning and rearing areas are located within the largest block of dedicated Wilderness in the 48 contiguous states, in Wild and Scenic River corridors and National Recreation Areas, and remain in excellent condition. Possible affects of this program on listed anadromous species include ecological interactions like competition with other species or genetic affects on naturally occurring sockeye.

3.3.1 Species Considered

Since 1991, NMFS has identified 12 Evolutionarily Significant Units (ESU) of Columbia River Basin salmon and steelhead as requiring protection under the ESA. Four of the listed ESUs originate in the Snake River basin. The populations expected to occur within the action area covered in this EA and their current listing status are shown below. The ESA-listed populations include some portion of artificially propagated fish as well as the wild/natural populations.

a) Snake River spring/summer chinook salmon, *Oncorhynchus tshawytscha*, listed as threatened on April 22, 1992 (57 FR 14653). This ESU includes tributaries to the Snake River upstream of the Snake and Columbia River's confluence. It includes all natural populations and certain hatchery produced components of spring and summer chinook salmon populations in the mainstem Snake River and the following sub-basins: Tucannon River, Grand Ronde River, Imnaha River, and Salmon River. Spring/summer chinook salmon returning to hatchery programs and supplementation programs in the Clearwater River are excluded because the native stocks were extirpated by dams and the current populations were reintroduced after the dams were breached (Matthews and Waples 1991).

b) Snake River fall chinook salmon, *Oncorhynchus tshawytscha*, were listed as threatened on April 22, 1992 (57 FR 14653). This chinook salmon ESU includes all natural populations of fall-run chinook salmon in the mainstem Snake River and the following sub-basins: Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River. Although not listed, the Snake River fall chinook stock maintained at Lyons Ferry hatchery is deemed to be included in the ESU and is utilized for rebuilding natural spawning populations (NMFS 1998).

c) Snake River sockeye salmon, *Oncorhynchus nerka,* were listed as endangered on November 20, 1991 (56 FR 58619). This population remains only in Redfish Lake, at the headwaters of the Salmon River, and in a captive propagation program designed to restore natural spawning populations in Redfish Lake and nearby Pettit and Alturas Lakes (Flagg and McAuley 1996).

d) Snake River Basin steelhead, *Oncorhynchus mykiss,* were listed as threatened on August 18, 1997 (62 FR 43937). This inland steelhead ESU occupies the Snake River basin of southeast Washington, northeast Oregon, and Idaho (Busby et al. 1996). Hatchery-origin

steelhead in the Tucannon River, Imnaha River, and East Fork Salmon River have recently been derived from listed, natural populations and are listed.

3.3.2 Species Descriptions

3.3.2.1 Snake River Spring/Summer Chinook Salmon

Spring chinook salmon destined for the Snake River and tributaries begin entering the Columbia River in late February and early March. Their abundance downstream from Bonneville Dam peaks in April and early May. All chinook salmon passing Bonneville Dam from March through May are counted as spring chinook salmon. All chinook salmon passing Bonneville Dam from June 1 through July 31 are counted as summer chinook salmon. These fish enter the Snake River approximately two weeks after crossing Bonneville Dam and distribute to the tributaries where they spawn in August and September. Although certain populations clearly cross Bonneville Dam in the spring or summer time period, the separation by time and geography is less clear in the Snake River, and spring-run and summer-run chinook are considered to be components of the same ESU (NMFS 1998).

3.3.2.2 Snake River Fall Chinook Salmon

Fall chinook salmon cross Bonneville Dam after August 1 each year and arrive in Idaho in September and October. In the Snake River, habitat utilized by fall chinook salmon for spawning and early juvenile rearing is different from that utilized by spring-run and summer-run fish. The latter two forms spawn and rear in high elevation sections of the Salmon River and other tributary streams, whereas fall chinook salmon use mainstem areas of the Snake River and the low elevation parts of major tributaries. Spring/summer chinook salmon are described as having the "stream type" life history, which includes entering fresh water in an early stage of reproductive maturity and typically includes a yearling age smolt. Fall chinook typically enter freshwater in an advanced stage of maturity and produce subyearling smolts (NMFS 1998).

Snake River fall-run chinook salmon were determined to comprise a separate ESU from Snake River spring or summer chinook salmon based on differences in the timing of adult returns to spawning areas, different spawning areas, different life history, and genetic differences. Historically, the most important spawning grounds for fall chinook salmon in the Snake River were between Huntington, Oregon (river mile 328) and Auger Falls (river mile 607). The distribution of Snake River fall chinook salmon has been dramatically reduced and now represents only a fraction of its former range. The construction of dams inundated spawning habitat and prevented access to the species' primary production areas when fish passage facilities at the dams proved to be inadequate. The Snake River fall-run chinook salmon ESU is now restricted to approximately 100 miles of the Snake River between Lewiston and Hells Canyon Dam and the lower reaches of major tributaries in this reach (NMFS 1998).

3.3.2.3 Snake River Sockeye Salmon

Sockeye salmon migrate through the lower Columbia River during June and July, with normal peak passage at Bonneville Dam around July 1. Sockeye salmon runs include fish from a remnant Snake River stock listed as endangered since December 1991. Only a very few of these fish (fewer than 20 wild fish in the past 10 years) arrive at spawning areas near the headwaters of the Salmon River in August and September (BRT 2003).

3.3.2.4 Snake River Basin Steelhead

Summer steelhead enter the Columbia River from March through October, with most of the run entering from late June through mid-September. The upriver steelhead run has historically been separated into A and B groups, which pass Bonneville Dam before and after August 25. Group A steelhead include fish that pass Bonneville Dam from late June through August 25 on their way to tributaries throughout the Columbia and Snake River Basins. Group B steelhead return to the Clearwater and Salmon Rivers in Idaho and pass Bonneville Dam from August 26 through October. Individual Group B steelhead are generally larger in size than group A steelhead (Busby et al. 1996).

Group A and B steelhead cannot be distinguished based on run timing above Bonneville Dam, where groups mix as fish seek temporary refuge in tributaries where temperatures are cooler than in the mainstem. Steelhead counts at dams above Bonneville surge as mainstem water temperature declines in the fall. Counts peak at John Day, McNary, and the Snake River Dams in September and October. During years of above-average September-October flows and low temperatures, steelhead move readily past lower Snake River dams during the fall counting period (June-December) and few fish are delayed until the spring count period (March-May).

3.4 Other ESA-Listed Fish Species

One other ESA-listed fish species is expected to be present in the area affected by the Proposed Action. The Columbia River population segment of bull trout (*Salvelinus confluentus*) was listed as threatened by the USFWS in 1998 (June 10, 1998, 63 FR 31647). Critical habitat was designated for the Columbia River population of bull trout in 2004 (October 5, 2004, 69 FR 59996). Bull trout populations are known to exhibit four distinct life history forms: resident, fluvial, adfluvial, and anadromous. Resident bull trout spend their entire life cycle in the same (or nearby) streams in which they were hatched. Fluvial and adfluvial populations spawn in tributary streams where the young rear from 1 to 4 years before migrating to either a lake (adfluvial) system or a river (fluvial) system, where they grow to maturity. Anadromous fish spawn in tributary streams, with major growth and maturation occurring in salt water. More information on bull trout can be found in Rieman and McIntyre (1993) and in the listing notice.

Migratory bull trout have been restricted or eliminated due to stream habitat alterations, including seasonal or permanent obstructions, detrimental changes in water quality, increased temperatures, and the alteration of natural stream flow patterns. The disruption of migratory corridors, if severe enough, would result in the loss of migratory life history types and isolate

resident forms from interacting within the metapopulation. The Columbia River population segment encompasses a vast geographic area including portions of Idaho, Montana, Oregon, Washington, and British Columbia.

Within the Snake River basin, in waters occupied by anadromous salmon and steelhead, bull trout primarily exhibit the fluvial life history, with small populations showing adfluvial and resident life histories. Also within the Snake River basin, there is likely some degree of connectivity among the populations in the Snake River and its major tributaries (Batt 1996). The range of bull trout in the Snake River Basin approximates the distribution of anadromous fish (Batt 1996). Bull trout are present, and locally common, in all of the rivers and streams occupied by anadromous fish in the Snake River basin. According to the USFWS listing notice for bull trout (63 FR 31647), there are 34 bull trout populations occupying 14 major tributaries of the Snake River. Although habitat fragmentation is a concern for bull trout populations in portions of the range, the listing notice concludes:

> *"The [Snake River] basin downstream from Hells Canyon Dam is relatively intact and connectivity among bull trout sub-populations may still occur. Bull trout occupy large areas of contiguous habitat in the Snake River basin downstream from Hell's Canyon Dam, such as in the Clearwater River and Salmon River basins. High numbers of bull trout have been observed in the Tucannon River, Imnaha River, Clearwater River, Salmon River, and Malheur River subpopulations, however, trends in abundance are largely unknown or declining"* (63 FR 31647).

Much of the bull trout habitat in the Snake River basin occurs in federally designated Wilderness or other specially designated Federal lands. For example, the upper reaches of the Lochsa River and nearly the entire Selway River are located within the Selway-Bitterroot Wilderness. The upper Salmon River is located in the Sawtooth National Recreation Area and the Sawtooth and Frank Church Wilderness areas. The Middle Fork Salmon River and many main Salmon River Tributaries are located within the Frank Church/River-of-No-Return Wilderness. The Imnaha River starts in the Eagle Caps Wilderness and flows most of its length through the Hells Canyon National Recreation Area, which also includes the main Snake River and some Salmon River tributaries. Because anadromous salmonids and bull trout are federally listed species and are considered to be outstanding resource values on the National Forests, special care is taken by the land management agencies towards habitat protection. Possible affects of this program on bull trout would be limited to ecological interactions such as nutrient recycling and predation.

The action area does not include critical habitat designated for bull trout, primarily due to exclusion of the Salmon River subbasin from the designation (October 5, 2004, 69 FR 59996). Certain areas of the state of Idaho are included in the critical habitat designation, but these are not in the upper Salmon River basin, in the lakes in which the captive propagation program operates, or in the mainstem Snake and Columbia River migration corridors through which the sockeye salmon pass. The primary constituent elements of critical habitat for bull trout include water temperature, interconnectedness of habitat areas, stream channel complexity, and water

availability, none of which would be affected by the captive propagation program if it did operate in critical habitat areas.

3.5 Non-listed Fish Species

Approximately 60 other species of fish live in the Snake River and tributaries. About half are native species primarily of the families Salmonidae, Catastomidae, Cyprinidae, and Cottidae. White sturgeon *(Acipenser transmontanus)* occur in the main Snake and Salmon Rivers. The Snake River basin also supports at least 25 introduced species primarily representing Percidae, Centrarchidae, and Ictaluridae (Simpson and Wallace 1978). The most common resident species likely to occur in waters occupied by anadromous fish are native populations of mountain whitefish (*Prosopium williamsoni*), west slope cutthroat trout (*Oncorhynchus clarki*), rainbow trout (resident *O. mykiss*), dace (*Rhinichthys* spp.), and sculpin (*Cottus* spp.)

Introduced brook trout (*Salvelinus fontinalis*) are abundant in some tributaries. Brook trout are often regarded as a risk to native trout and salmon populations in western streams because of competition and predation (Griffith 1988). The species is prolific and predaceous and may completely replace native trout species in streams (Behnke 1992). Brook trout are also known to hybridize with bull trout to the detriment of the listed species (Simpson and Wallace 1978). Brook trout were widely introduced in the western United States by state and Federal resource managers for many years because they are capable of supporting popular recreational fisheries and are adaptable to a wide range of stream and lake habitats (Dill and Cordone 1997). However, in recent years, IDFG has adopted management strategies to reduce brook trout populations through generous bag limits (25 per day) and long open seasons in an attempt to reduce impacts on native salmonids (IDFG 2000, 2004a).

Northern pikeminnow (formerly northern squawfish) (*Ptychocheilus oregonensis*) have been identified as the predominant fish predator affecting survival of juvenile salmonids migrating downstream in the Snake and Columbia Rivers (BPA 1991). As a result, several attempts to reduce the numbers of northern pikeminnow in the migration corridor have been undertaken, including a system of paying bounties to recreational anglers for the carcasses of pikeminnow over 11 inches in length caught in the migration corridor (BPA 1991). This program has successfully reduced the number of larger, predaceous pikeminnow in certain areas and is believed to have improved the survival of juvenile salmonids (Beamesderfer et al. 1996). Northern pikeminnow continue to be abundant throughout the recorded range of the species (Beamesderfer et al. 1996). Possible affects of this program on non-listed resident fish species would be limited to ecological interactions such as nutrient recycling and predation.

3.6 Terrestrial Organisms

The Snake River basin includes terrain that ranges in elevation from 700 feet above mean sea level at the confluence of the Snake and Clearwater Rivers to over 12,600 feet above mean sea level in the headwaters of the Salmon River. Ecosystem maps, wildlife distribution maps, and

species lists are contained in "Atlas of Idaho's Wildlife" (Groves et al. 1997) – descriptive information is briefly summarized here. Within the varied terrain, all 25 of the identified vegetative ecosystems that have been identified in Idaho occur. These ecosystems range from alpine to urban and salt desert to temperate red cedar and hemlock rain forest and support a variety of terrestrial wildlife and plants. The state of Idaho supports 364 known species of vertebrates as reproducing populations, nearly all of which are expected to occur within the Snake River basin. Three mammal species and one bird species that may occur in the Snake River basin are listed under the ESA. Gray wolf (*Canis lupus*) occur as an introduced population with an Experimental/Non-essential designation. Canada lynx (*Lynx canadensis*), Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*), and bald eagle *(Haliaeetus leucocephalus*) are listed as threatened (USFWS 2004).

3.7 Social and Economic Resources

Salmon are culturally, economically, and symbolically important to the Pacific Northwest. Columbia River chinook salmon populations were at one time acknowledged to be the largest in the world. Prior to the 1960s, the Snake River basin was the most important drainage in the Columbia River system for producing salmon (NMFS 1995). Native Americans lived, fished, and hunted throughout this area for thousands of years. Salmon were an important aspect of the cultural life and subsistence of the Indian tribes that occupied the Salmon River mountains. Early gold strikes and mining activity in the Salmon and Clearwater sub-basins brought the first non-Indian settlers to the area in the 1800s. Salmon provided subsistence fishing for the early miners and ranchers and later supported popular recreational fishing and contributed to an active outfitting and guiding industry in the Snake River country. The cultural importance and former abundance of salmon is memorialized in the names of geographic features and landmarks like the Salmon River, Salmon City, Salmon Falls, and Redfish Lake.

The depleted status of salmon populations in the 1970s, 1980s, and 1990s ended many of the cultural practices and subsistence uses of salmon made by the indigenous Indian tribes and curtailed the economic and cultural benefits of the non-Indian recreational fisheries that the salmon resource formerly supported. Recent increases in fishing activities supported by hatchery-produced salmon and steelhead provide an indication of the value of recreational fishing (Reading 1998). Approximately 450,000 anglers expend 4.5 million days of angling effort in Idaho each year (IDFG 1993). In 1996, 483,459 anglers spent over 4,411,000 angler days fishing in Idaho waters (Maharaj and Carpenter 1997). Angler expenditures of about $280,000,000 generated an economic output of over $461,682,000 and $116,552,000 in worker earnings. These wages and salaries translate into 6,884 full-time equivalent jobs (Maharaj and Carpenter 1997). Recreational fisheries for salmon and steelhead similar to those considered under the Proposed Action would be estimated to add some $180 million to the economy of the state annually and support as many as 5,400 jobs (Reading 1998).

The primary social and economic effect of the proposed program is the social and cultural value attached to the continued existence of sockeye salmon in the Snake River and the economic

value of non-consumptive wildlife observation. In the 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation, there were 868,000 Idaho residents and non-residents who participated in outdoor recreation in Idaho, and 643,000 of these recreationists participated in non-consumptive wildlife watching (USFWS 2003). Wildlife watching accounted for $227 million in expenditures for equipment and travel. Restoration of naturally spawning sockeye is a potential wildlife observation opportunity that is of interest to the public. Non-consumptive, wildlife-related recreational opportunities are important to the social and cultural makeup of Idaho and also are important to local economies. Overall, wildlife-related recreation provides substantial income and important employment opportunities in remote rural communities located in the Snake River basin.

3.8 Environmental Justice

Executive Order 12898 (February 11, 1994, 59 FR 7629) states that Federal agencies shall identify and address, as appropriate "…disproportionately high and adverse human health or environmental effects of [their] programs, policies, and activities on minority populations and low-income populations…." While there are many economic, social, and cultural elements that influence the viability and location of such populations and their communities, the development, implementation, and enforcement of environmental laws, regulations, and policies can also have impacts. Therefore, Federal agencies, including NMFS, must ensure fair treatment, equal protection, and meaningful involvement for minority populations and low-income populations as they develop and apply the laws under their jurisdiction.

In the proposed action area, there are minority and low income populations that this Executive Order could apply to, including Hispanics, Asians, and Native Americans. The U. S. Census Bureau reported the race composition of Idaho residents in 2000 (U.S. Census Bureau 2004) to be 88.0 percent White, 7.9 percent Hispanic, 1.4 percent Native American, 0.9 percent Asian, and 1.8 percent black.

3.9 Tribal Trust Responsibilities and Treaty Rights

The United States has a unique relationship with tribal governments as set forth in the Constitution, treaties, statutes, and Executive orders. This body of statutes, treaties and policies, together with Federal court rulings that interpret them, is commonly spoken of as "Treaty Trust Doctrine." In keeping with this unique relationship and with the mandates of the Presidential Memorandum on Government to Government Relations With Native American Tribal Governments (May 4, 1994, 59 FR 22951), with Executive Order 13084 (Consultation and Coordination With Indian Tribal Governments; May 19, 1998, 63 FR 27655), and with Secretarial Order 3206 on "American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act" (June 5, 1997), NMFS developed and published a section 4(d) rule regarding Tribal resource management (July 10, 2000, 65 FR 42481). Recognizing the unique status of the Treaty Tribes, the Federal Government stated, in the explanatory material accompanying the rule, that the appropriate expression of its trust obligation is a commitment to

harmonize its many statutory responsibilities with the tribal exercise of tribal sovereignty, tribal rights, and tribal self determination. While the action considered in this EA is not proposed under the Tribal resource management section of 4(d), the commitment to following trust responsibilities applies.

Dating back to 1855, the Federal government signed treaties with the Nez Perce Tribe and the Shoshone-Bannock Tribes reserving rights for traditional tribal uses such as hunting, fishing, and gathering of plant materials on unoccupied public lands and in areas ceded by the tribes to the United States (Kappler 1904). Much of the state of Idaho includes traditional foraging areas for these tribes.

4. ENVIRONMENTAL CONSEQUENCES

This section of the assessment evaluates the potential effects of the alternatives on the biological, physical, and human environments. NMFS' determination to issue permits could affect a variety of natural and human resources. These effects would be primarily indirect effects of permit issuance, occurring as a result of implementation of activities described in the permit application.

4.1 Alternative 1 (No Action) – Issue No Permits

Under this alternative, no permit for take of listed Snake River spring/summer chinook salmon, fall chinook salmon, steelhead, or sockeye salmon would be issued. It would not be possible for IDFG and NWFSC to implement the proposed artificial propagation program without take of listed salmon, so the implementation of the Redfish Lake Sockeye Salmon Captive Propagation Program would result in the unauthorized take of ESA-listed anadromous fish species. Therefore, the conduct of the Redfish Lake Sockeye Salmon Captive Propagation Program could not proceed without violating the ESA, and the No Action alternative would effectively prohibit continuation of the program.

4.1.1 Effects on Riparian Habitat

Under the No Action alternative, no additional adverse or beneficial impacts of any magnitude on riparian habitat would be expected to occur. The Redfish Lake Sockeye Salmon Captive Propagation Program would be terminated. The status of the habitat conditions would not change. No geological impacts would occur.

4.1.2 Effects on Water Quality

The No Action alternative would not be expected to result in either beneficial or adverse impacts on water quality. If the Redfish Lake Sockeye Salmon Captive Propagation Program was terminated, no fish would be reared or released, and no activities related to this particular propagation program would take place near streams or affecting water quality. However, because any potential for adverse effects on water quality from the program as currently operated are very small and localized, the benefits to water quality resulting from termination of the program would be negligible. No improvements in listed 303(d) streams would occur as a result of termination of the program, as irrigation withdrawals, land use, and highway maintenance activities would continue.

4.1.3 Effects on Anadromous Fish Listed Under the ESA

Under the No Action alternative, the Redfish Lake Sockeye Salmon Captive Propagation Program would be terminated, no artificially propagated sockeye would be reared or released. Snake River sockeye salmon would likely become extinct within one or two generations unless some other conservation measures were initiated. Sockeye salmon were an important part of the fully functional ecosystem of the upper Salmon River as they added nutrients to the nursery lakes and tributaries and as components of the natural ecosystem within which Snake River spring/summer chinook salmon and steelhead evolved. Restoration of sockeye is expected to provide a more normative, productive, and sustainable ecosystem for the other native fish species, including anadromous chinook salmon and steelhead. Therefore, the no action alternative is a potential detriment to the other native species that share the same waters, as a result of reduced environmental diversity. With or without the sockeye restoration program, the other listed anadromous salmonid ESUs in the Snake River basin listed under the ESA – spring/summer chinook salmon, fall chinook salmon, and steelhead – will continue to remain at depressed levels. The No Action alternative would not contribute to restoration of the listed population.

Anadromous adult salmon and steelhead returning to Lower Granite Dam would still be subject to effects of the trap at the fishway, as trapping would continue for other species and purposes.

4.1.4 Effects on Other ESA-listed Fish Species

Under the No Action alternative, the other ESA-listed fish species, threatened bull trout, would not be substantially affected. Bull trout are known to be predators of other native salmonids (Simpson and Wallace 1978). Bull trout probably consume a small number of the juvenile sockeye currently being produced by the captive propagation program and would likely benefit from restoration of a naturally producing sockeye population. Sockeye salmon were an important part of the fully functional ecosystem of the upper Salmon River as they added nutrients to the nursery lakes and tributaries and as components of the natural ecosystem within which bull trout evolved. Restoration of sockeye is expected to provide a more normative, productive, and sustainable ecosystem for the other native fish species including bull trout. Therefore the proposed action has potential benefits while the no action alternative is a potential detriment to the other native species that share the same waters. Termination of the program

would reduce forage availability for bull trout residing in the nursery lakes and the migration corridor and might have a small adverse impact on bull trout growth and survival. However, bull trout have alternate forage species available, such as kokanee in the nursery lakes and juvenile chinook in the tributary and outlet streams.

The action area does not include critical habitat designated for bull trout. Cessation of the captive propagation program would not, therefore, affect any of the primary constituent elements of bull trout critical habitat in those areas where it has been designated. Water quantity, quality, and continuity in critical habitat would remain areas of concern, as would such issues as simplification of stream channels and quality of substrates for bull trout eggs and juveniles. Any bull trout encountering the fishway at Lower Granite Dam would still be subject to effects of the trap at the fishway, as trapping would continue for other species and purposes.

4.1.5 Effects on Non-listed Fish Species

Under the No Action alternative, non-listed resident fish species would not benefit from possible increases in the listed sockeye population. Sockeye salmon were an important part of the fully functional ecosystem of the upper Salmon River as they added nutrients to the nursery lakes and tributaries and as components of the natural ecosystem within which the other native fish species evolved. Restoration of sockeye is expected to provide a more normative, productive, and sustainable ecosystem for those other native fish. Therefore the proposed action has potential benefits while the no action alternative is a potential detriment to the other native species that share the same waters. Some resident species like northern pikeminnow and mountain whitefish would be affected by minor reductions in forage availability, while the resident kokanee in the nursery lakes could benefit by reduced competition from sockeye juveniles.

4.1.6 Effects on Terrestrial Organisms

Selection of the No Action alternative would probably lead to small reductions in the number of fish carcasses available to terrestrial organisms for food and nutrients. Terrestrial species would be expected to benefit from a more normative, productive, and sustainable ecosystem that included a restored sockeye population, as proposed by the other alternatives.

4.1.7 Effects on Social and Economic Resources

Selection of the No Action alternative would leave the captive propagation program without authorization for take of listed species, effectively prohibiting its continuation. The Redfish Lake Sockeye Salmon Captive Propagation Program would be terminated. The sockeye ESU would likely go extinct and options for recovery would be eliminated.

The primary value of restored sockeye populations would be the social and cultural values attached to the existence of the unique fish species. Those values would diminish if sockeye become extinct. Wildlife observation is important to the lifestyle of the residents of Idaho as well as tourists who travel to Idaho specifically to enjoy outdoor recreation. There is also an economic value attached to the willingness of people to travel and see wildlife that would be lost in part if the sockeye population becomes extinct.

The potential social and economic benefits of a restored sockeye population would be denied to local cultures and economies that depend upon outdoor recreation in the proposed action area. Monetary and aesthetic benefits would be lost by the economy and culture of small rural communities in the Snake River basin under the No Action alternative.

4.1.8 Environmental Justice

Executive Order 12898 (February 11, 1994, 59 FR 7629) directs Federal agencies to identify and address, as appropriate, any disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. The No Action alternative would disproportionately affect the depressed economies of small rural communities in areas suffering from high unemployment due to depressed timber, mining, and agricultural-based economies. Larger communities, where the economy is based on industry and commerce, would not be as likely to suffer as small rural communities that depend on resource utilization and tourism. Individuals and communities with high annual incomes based on salaries from industry or government would not be affected proportionately as individuals and communities with low income based on tourism, service, and resource utilization (Reading 1998). For example, in Ada County, which is an urban county surrounding the State Capital at Boise, where government and technology are the major aspects of employment, per capita annual income is $27,240, and only 9.1 percent of the residents live below the poverty level. In Lemhi County, a rural county where the county seat is Salmon (population 3,000), and where fishing and tourism is an important source of income, the per capita income is $15,786 and 15.5 percent of the residents live below poverty levels (IDOC 2004). In December 2003, unemployment in Lemhi County was 8.2 percent compared to the Idaho average of 5.0 percent and Ada County at 3.2 percent (USDL 2004). Adverse effects of lost resources would be greatest on poor, rural communities compared to wealthier, urban communities (IFWF 2002). However, it is not clear what magnitude of effect would result from the program over the near term – benefits of the Proposed Action would likely not show up until the sockeye salmon program was returning substantial numbers of fish, which is not likely to be for a number of years. Therefore, while adverse effects of the No Action alternative on communities might be large in the long term, in the near term there is likely to be little discernible effect.

4.1.9 Effects on Treaty Trust Responsibilities

The Shoshone-Bannock Tribes are very interested in recovery of sockeye for subsistence fishing and for the cultural values of the fish to the tribe whose traditional areas include the Stanley Basin and the sockeye nursery lakes. The Shoshone-Bannock Tribes petitioned NMFS to list the Snake River sockeye ESU and are cooperators in the sockeye captive propagation program. The No Action alternative would not be responsive to the Tribe's desires to restore the sockeye resource. In the absence of compelling reasons to deny the program under consideration, particularly given the tribal role in the implementation of the program on tribally-important lands, not issuing a permit for the program could have adverse consequences for management of treaty trust resources.

4.2 Alternative 2 (Proposed Action) - Issue Permits to IDFG and NWFSC for Continuation of the Sockeye Salmon Captive Propagation program

The Proposed Action is to issue permits under section 10(a)(1)(A) of the ESA based on the applications, including attachments, submitted by IDFG and NWFSC as modified by the conditions that NMFS/SRD may require as being necessary and appropriate.

4.2.1 Effects on Riparian Habitat

The effects on riparian habitat resulting from issuing permits that allow conduct of the Redfish Lake Sockeye Salmon Captive Propagation Program would be limited to the installation and operation of weirs and traps and the existence of fish culture facilities. The weirs used to trap adult sockeye are located at permanent sites that have been in use for over 30 years. Disturbance to riparian areas is very small, similar to effects under the No Action alternative. Most of the fish culture facilities are located off-site and have no effect on the riparian vegetation of the Salmon River basin. Sawtooth Hatchery, where some of the trapping occurs and some rearing of juveniles is conducted was built for chinook and steelhead programs and the addition or subtraction of the small sockeye program would not alter the affects of the facility. Compared to the No Action alternative, there would a small increase in human activity in riparian areas, though not likely to an extent to create a measurable adverse impact to that habitat's condition. No effects on geology of the area would be expected.

4.2.2 Effects on Water Quality

Under the Proposed Action, adverse effects on water quality would be slightly higher than under the No Action alternative. Rearing sockeye juveniles and holding adults would increase the water demands and nutrient discharge of hatchery facilities, but to a very minor extent compared to the baseline levels generated by natural runoff, land use, and other human activities. In most cases, water quality effects are expected to be small, temporary and localized. The over-all and long-term adverse effects on water quality resulting from the Proposed Action are expected to be negligible. Because of this, no adverse effects on streams listed or potentially subject to listing under section 303(d) are expected.

4.2.3 Effects on Anadromous Fish Listed Under the ESA

Under the Proposed Action, substantial benefits are expected for listed anadromous fish compared to no benefits or adverse impacts under the No Action alternative. Issuance of the proposed permit with conditions specified by NMFS is estimated to have the following effects on survival of listed anadromous fish compared to the No Action alternative:

4.2.3.1 Snake River Spring/Summer Chinook Salmon

Sockeye salmon were an important part of the fully functional ecosystem of the upper Salmon River as they added nutrients to the nursery lakes and tributaries and as components of the natural ecosystem within which Snake River spring/summer chinook salmon evolved. Restoration of sockeye is expected to provide a more normative, productive, and sustainable ecosystem for the other native fish species including spring/summer chinook. Therefore the

proposed action has potential benefits for chinook that share the same waters. If additional sockeye salmon broodstock collection were to occur at Lower Granite Dam, no additional effects on other species passing during the summer time period are expected, as the collection would occur during trapping activities already underway.

4.2.3.2 Snake River Fall Chinook Salmon

Snake River fall chinook salmon primarily occupy portions of the Snake River far removed from the nursery lakes and the upper Salmon River. Snake River fall chinook spawn and rear in the mainstem Snake River and lower Clearwater River and are only in the migration corridor for a short period at the same time as sockeye. The proposed action is not likely to have any affect on fall chinook. If additional sockeye salmon broodstock collection were to occur at Lower Granite Dam, no additional effects on other species passing during the summer time period are expected, as the collection would occur during trapping activities already underway.

4.2.3.3 Snake River Sockeye Salmon

The proposed action is to issue permits that allow continuation of the captive propagation program that has prevented extinction of the Snake River sockeye ESU. The subject program has prevented extinction of this endangered ESU for the past 13 years and has substantially amplified the abundance of listed fish while maintaining the genetic diversity of the ESU and preserving options for future recovery actions. When the captive propagation program was initiated in 1991, there were only 4 anadromous adults and a few hundred juveniles in the entire ESU. Currently, there are several hundred maturing adults each year and annual eyed-egg production is 200,000 to 300,000. The program has produced over 300 anadromous adults (Hebdon et al. in press). Compared to the No Action alternative, which would effectively terminate the captive propagation program and lead to extinction, the proposed action provides substantially increased benefits for the listed ESU.

While the captive propagation program operated by IDFG and NWFSC since 1991 has, for the short term, prevented extinction of the Snake River sockeye ESU and has amplified the abundance of the ESU many times, the program has not successfully established self sustaining populations in the wild. The current captive population is a "closed" population in which all the fish are related to the very small founding population and to each other (Flagg et al., in press). Even though sophisticated management techniques such as DNA screening are used to select mates and careful family pedigrees are maintained to avoid mating siblings or near relatives, the risk of inbreeding and loss of genetic diversity is increasing with each generation (Flagg et al., in press). Geneticists supporting the SBSTOC have calculated that, with a limited population in a random mating situation, up to 40% of the heterozygosity of the ESU may be lost in the next 10 generations of captive propagation and have recommended that additional measures be taken to increase the abundance of anadromous returns and the number of fish spawning naturally (Flagg et al., in press). The strategy of releasing full-term, hatchery-reared smolts has been the most successful in returning adult, anadromous, sockeye (Hebdon et al., in press). Without substantive improvements in smolt-to-adult survival and increased numbers of fish spawning in

nature, the loss of genetic diversity of the remaining population is predicted to accelerate with each generation the population remains closed (Flagg et al., in press).

Measures including trapping and transportation of adult sockeye from Lower Granite Dam are being considered to improve survival and increase the contribution to spawning from the anadromous component of the Snake River sockeye ESU. In general, the SBSTOC and the program operators have chosen the least-intrusive options for captive culture as a way to manage risk of artificial selection. However, in the near-term, and until the reasons for poor survival in the migration corridor are identified and addressed, the more-intrusive options such as trap-and-transport are likely to be beneficial to the recovery and survival of this ESU. Because trapping at Lower Granite Dam would not typically be instituted unless conversion rates were expected to be poor, the sockeye salmon trapped would represent fish that were likely to die prior to reaching spawning areas, but instead (under the proposed action) would then be likely to contribute to the gene pool at the hatchery.

4.2.3.4 Snake River Basin Steelhead

Sockeye salmon were an important part of the fully functional ecosystem of the upper Salmon River as they added nutrients to the nursery lakes and tributaries and as components of the natural ecosystem within which Snake River basin steelhead evolved. Restoration of sockeye is expected to provide a more normative, productive and sustainable ecosystem for the other native fish species including steelhead. If additional sockeye salmon broodstock collection were to occur at Lower Granite Dam, no additional effects on other species passing during the summer time period are expected, as the collection would occur during trapping activities already underway.

4.2.4 Effects on Other ESA-listed Fish Species

Sockeye salmon were an important part of the fully functional ecosystem of the upper Salmon River as they added nutrients to the nursery lakes and tributaries and as components of the natural ecosystem within which bull trout evolved. Bull trout are considered to be a top level predator among the native fishes of the Salmon River and restoration of salmon populations, including sockeye, is expected to increase the flow of marine nutrients into the fresh water systems and the availability of forage for predatory species. If additional sockeye salmon broodstock collection were to occur at Lower Granite Dam, no additional effects on bull trout that might use the fishway during the summer time period are expected, as the collection would occur during trapping activities already underway. Restoration of sockeye is expected to provide a more normative, productive, and sustainable ecosystem for the other native fish species including bull trout.

The action area does not include critical habitat designated for bull trout, so no effects are expected.

4.2.5 Effects on Non-listed Fish Species

Sockeye salmon were an important part of the fully functional ecosystem of the upper Salmon River as they added nutrients to the nursery lakes and tributaries and as components of the natural ecosystem. All of the native fishes of the Salmon River and some introduced species are likely to benefit from restored salmon populations, including sockeye, because of increasing the flow of marine nutrients into the fresh water systems and the availability of forage for predatory species. Restoration of sockeye is expected to provide a more normative, productive, and sustainable ecosystem for the other native fish species. Therefore, the proposed action has potential benefits while the no action alternative is a potential detriment to other species that share the sockeye ecosystem.

4.2.6 Effects on Terrestrial Species

Compared to the No Action alternative, some positive impacts on terrestrial species from the Proposed Action are expected. The beneficial ecological affects of restored sockeye populations are expected to spread through nutrients added to riparian vegetation and both primary and secondary consumption of carcasses by terrestrial organisms.

4.2.7 Effects on Social and Economic Resources

Compared to the No Action alternative, the impacts on social and economic resources from the Proposed Action are expected to be beneficial. According to the 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation, there were 868,000 Idaho residents and non-residents who participated in outdoor recreation in Idaho, and 643,000 of these recreationists participated in non-consumptive wildlife watching (USFWS 2003). Wildlife watching accounted for $227 million in expenditures for equipment and travel. Restoration of naturally spawning sockeye is a potential wildlife observation opportunity that is of interest to the public. Non-consumptive, wildlife-related recreational opportunities are important to the social and cultural makeup of Idaho and also are important to local economies. Overall, wildlife-related recreation provides substantial income and important employment opportunities in remote rural communities located in the Snake River basin. The proposed action would result in some increase in wildlife-related recreational opportunity and, therefore, would be expected to increase income and employment opportunity in some local areas compared to the No Action alternative.

4.2.8 Environmental Justice

Executive Order 12898 (February 11, 1994, 59 FR 7629) directs Federal agencies to identify and address, as appropriate, any disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Compared to the No Action alternative, the Proposed Action alternative would be expected to be more responsive to the intent of the executive order, as all groups would share equally in the economic and cultural benefits of wildlife-related recreation. Wildlife-related recreation provides substantial income and important employment opportunities in remote, rural communities located in the Snake River basin. Under the Proposed Action alternative, increased wildlife-related recreational opportunities may result as compared to the No Action alternative. These opportunities would

be available to all population segments. The Proposed Action is not expected to adversely affect human health of any population located in the action area.

4.2.9 Effects on Treaty Trust Responsibilities

The Proposed Action is more responsive to Treaty Trust responsibilities and policies than the No Action alternative. As explained above in subsections 1.1 and 3.9, the Federal Government has an obligation to work collaboratively with the Tribes to facilitate management of treaty trust resources. Issuing the two proposed permits would allow the continuation of a conservation program that has had substantial input by tribes, particularly the Shoshone-Bannock Tribes, at a level greater than under the No Action alternative. The Shoshone-Bannock Tribes are very interested in the cultural aspects as well as eventual opportunities for ceremonial and subsistence uses of a restored sockeye population.

4.3 Alternative 3 - Issue a Permit Without Conditions

Issuing the permit with no additional conservation conditions attached would be expected to have biological and environmental impacts similar to those discussed under the Proposed Action alternative. Policies adopted by the Idaho Fish and Game Commission and State statutes as implemented by IDFG place a high priority on conservation actions to protect native species, anadromous salmonids, and aquatic habitats (IDFG 2000). Conservation measures adopted by the IDFG would not be expected to change if there were no requirements and conditions in the permit. The NWFSC is also bound by Federal laws to employ all of its authorities to restoration of listed species and would be expected to adopt and implement appropriate conservation actions. However, NMFS' ability to monitor the program effects and to document compliance with the ESA would be limited without conditions requiring monitoring and reporting. The action of reviewing and analyzing the conservation plan and formalizing the conservation measures as permit conditions ensures that the most current conservation science is applied and risks to the continued survival and recovery of listed species are carefully monitored and managed.

4.3.1 Effects on Riparian Habitat

The effects of this alternative would be similar to the Proposed Action. It is likely that the program would continue similar to the past and current operation so that effects on riparian habitat would be the same between this alternative and the Proposed Action. There would be some slight effect on areas immediately adjacent to hatchery facilities and weirs, but no additional disturbance would occur.

4.3.2 Effects on Water Quality

The effects of this alternative, compared to the Proposed Action and No Action alternatives, would be similar to the Proposed Action. It is likely that the program would continue similar to the past and current operation so that effects on water quality would be the same between this alternative and the Proposed Action. While this alternative would likely have greater adverse

effects on water quality than the No Action alternative, over-all and long-term effects on water quality resulting from this action would be expected to be negligible.

4.3.3 Effects on Anadromous Fish Listed Under the ESA

The effects of this alternative, compared to the Proposed Action and No Action alternatives, would be similar to the Proposed Action. Policies adopted by the Idaho Fish and Game Commission and State statutes as implemented by IDFG place a high priority on conservation actions to protect native species, anadromous salmonids, and aquatic habitats (IDFG 2000). Conservation measures adopted by the IDFG would not be expected to change if there were no requirements and conditions in the permit. The NWFSC is also bound by Federal laws to employ all of its authorities to restoration of listed species and would be expected to adopt and implement appropriate conservation actions. However, NMFS' ability to monitor the program effects and to document compliance with the ESA would be limited without conditions requiring monitoring and reporting. With a permit in place, IDFG and NWFSC would not be in violation of the ESA, but without permit reporting conditions, the degree of compliance with ESA goals and purposes might not be measured or documented, and information important to future planning and management wouldn't necessarily be collected.

4.3.4 Effects on Other ESA-listed Fish Species

The effects of this alternative, compared to the Proposed Action and No Action alternatives, would be similar to the Proposed Action. Bull trout would be expected to benefit from a more normative, productive, and sustainable ecosystem that included a restored sockeye population. As under the Proposed Action, if additional sockeye salmon broodstock collection were to occur at Lower Granite Dam, no additional effects on other species passing during the summer time period are expected, as the collection would occur during trapping activities already underway.

The action area does not include critical habitat designated for bull trout, so no effects are expected.

4.3.5 Effects on Non-listed Fish Species

The effects of this alternative, compared to the Proposed Action and No Action alternatives, would be similar to the Proposed Action. The IDFG and NWFSC would likely continue to utilize prudent and scientific fishery management techniques responsive to their statutory mandates, although, as discussed above, the degree of compliance with conservation objectives wouldn't necessarily be clear, as important information would not necessarily be collected. Other fish species would be expected to benefit from a more normative, productive, and sustainable ecosystem that included a restored sockeye population.

4.3.6 Effects on Terrestrial Species

As with the other aspects of the affected environment, the effects of this alternative, compared to the Proposed Action and No Action alternatives, would be similar to the Proposed Action. Adverse impacts on terrestrial organisms, ESA-listed or unlisted, would be expected to be no greater than under the Proposed Action or No Action alternatives. Terrestrial species would be

expected to benefit from a more normative, productive and sustainable ecosystem that included a restored sockeye population.

4.3.7 Effects on Social and Economic Resources

Compared to the No Action alternative, the impacts on social and economic resources from Alternative 3 are expected to be beneficial, and similar to impacts under the Proposed Action. There would be similar nonconsumptive wildlife observation opportunities available, with economic and social impacts similar to those described in subsection 4.2.7.

4.3.8 Environmental Justice

Executive Order 12898 (February 11, 1994, 59 FR 7629) directs Federal agencies to identify and address, as appropriate, any disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Compared to the No Action alternative, this alternative would be expected to be more responsive to the intent of the executive order, as all groups would share equally in the economic and cultural benefits of recreational fishing. This alternative would have impacts most similar to the Proposed Action alternative with increased nonconsumptive wildlife observation opportunities available compared to the No Action alternative. These opportunities would be available to all population segments. Potential opportunities for low-income and minority persons could increase. This alternative would not be expected to affect human health of any population located in the action area.

4.3.9 Effects on Treaty Trust Responsibilities

The effects of this alternative would be similar to the Proposed Action. In contrast to the No Action alternative, this alternative is more responsive to treaty trust doctrine.

5. CUMULATIVE IMPACTS

Other Federal, tribal, and State actions are expected to occur within the Snake River basin and in the migration corridor between the Snake River and the Pacific Ocean that would affect the fish populations considered in the Proposed Action. State and tribal fisheries occur in Oregon and Washington portions of the Snake River basin and in the mainstem Columbia River. Land management and water use decisions that affect these populations are made inside and outside the Snake River basin. There are overarching concerns and legal mandates for the recovery of listed salmon and steelhead populations in the Columbia River basin, at the same time there are social and cultural needs for sustainable fisheries and sustainable economic use of resources.

There are numerous initiatives by State, Federal, tribal, and private entities designed to restore salmon and steelhead populations. Federal actions for salmon recovery in the Columbia River basin that are currently underway include initiatives by the Northwest Power and Conservation Council (NPCC) to mitigate impacts of the Federal Columbia River Power System (FCRPS). A small portion of that mitigation includes funding of the Redfish Lake Sockeye Salmon Captive Propagation Program by the Bonneville Power Administration. NPCC initiatives include

development of sub-basin plans in support of regional planning and recovery efforts. State initiatives include recently passed legislative measures to facilitate the recovery of listed species and their habitats, as well as the overall health of watersheds and ecosystems. Regional programs are being developed that designate priority watersheds and facilitate development of watershed management plans. Several tribes have developed a joint restoration plan for anadromous fish in the Columbia River basin, known as the Wy-Kan-Ush-Mi Wa-Kish-Wit or *Spirit of the Salmon* plan. All of these regional efforts are expected to help increase salmon and steelhead populations in the action area because of compatible goals and objectives.

The proposed Redfish Lake Sockeye Salmon Captive Propagation Program is also designed with a mandate for protection and recovery of the listed species under both Federal and State law and policy.

Success or failure of the captive propagation program is dependent upon and takes place within the context of the cumulative effects of salmon protection and restoration measures throughout the action area, including the migration corridor. Therefore, the cumulative impacts of NMFS' current Proposed Action are expected to be minor, because of requirements that would ensure compatibility with other conservation strategies. Within the action area, there are expected to be beneficial effects on the biological and human environments associated with the application of scientific fishery management to provide for sustainable benefits from a restored sockeye population. Application of artificial propagation and captive broodstock technology to sockeye recovery is only one element of a large suite of regulations and environmental factors that may influence the overall health of listed salmon populations and their habitat.

6. AGENCIES CONSULTED

National Marine Fisheries Service
U.S. Fish and Wildlife Service
Idaho Department of Fish and Game
Shoshone Bannock Tribe

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